

# Design News

Motor and relay regulate arc in welding head. P. 46



A CAHNERS PUBLICATION

NOVEMBER 10, 1961

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**Design News**

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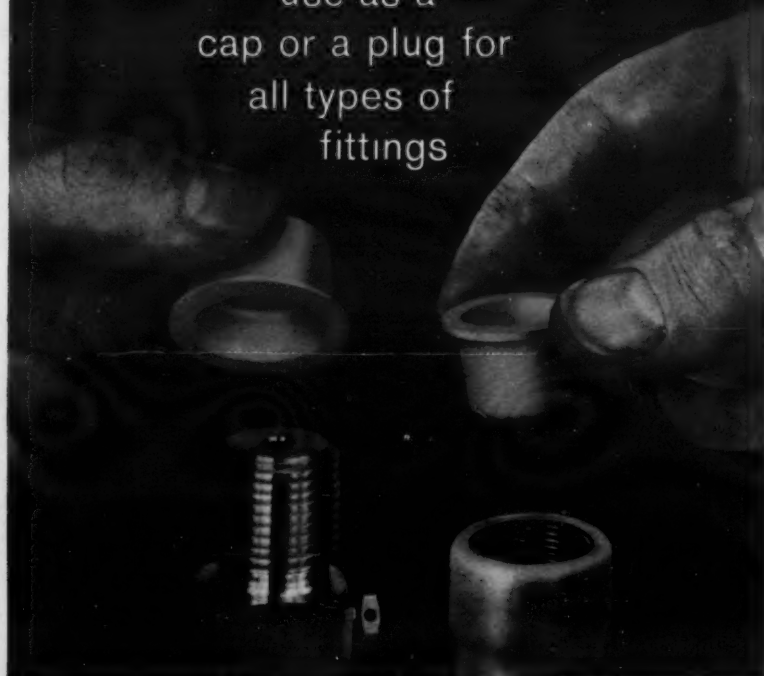


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## GUEST EDITORIAL

### Are You a Value-Able Engineer?

All design engineers have heard the old saw about an engineer being able to do for fifty cents what anybody can do for a dollar. How about the man who can do the same job for a quarter? This kind of engineer is in demand because he can really improve the competitive position of his company.

It is easy for an engineer to become solely performance oriented. When this happens, high costs and a complex product result. You as an engineer assign a certain irreducible price tag by your basic design. Production-engineer it to death and you still may have prohibitive costs. Only by knowledgeable cost orientation at the design stage can you achieve functional simplicity—and this means lower-cost designs with greater reliability. This is called value assurance and makes you a valuable man to your boss.

The defense budget has created a high-cost design situation that can only mean less-than-maximum defense potential. Use of the simple VE technique, called "Evaluate the Function", by top management when specifying requirements, and by engineers during design, will do much to lower costs. Most important, it will give us, as a nation, the greatest defense for the dollar.

Value engineers operating essentially as second guessers have produced some impressive and valid savings. Often the product is improved functionally as well. Does this make value men smarter than anyone else—or better engineers? Not at all. It only proves that any engineer with a cost-oriented approach can improve the value of the product. For maximum effectiveness this should be done early in the design stage. In tailor-made designs we never get a chance to second guess value into the product.

When you appraise your own worth as a design engineer, don't complain that simply getting required performance is problem enough. Engineers always have had such problems; upon the ability to solve these, your pay is partially based. But for any given performance requirement there are several solutions and as many different prices. Which solution would you buy if you were the customer? The one that would fulfill the requirement at the lowest cost, obviously.

Now if you were the boss and evaluating design engineers, what attributes would you look for besides the usual technical competence? Engineers who show they are "value-able" by consistently putting out designs that do the job and are producible at low cost should rank high on your "valuable" list. Cost-oriented engineers whose designs meet performance requirements should get the top positions in your outfit. As a design engineer, are you value-able?

R. E. Meyers  
Head, Value Engineering Branch  
San Francisco Naval Shipyard

## DESIGN VIEWS

### Value Engineering

Once again we are departing slightly from our usual format in presenting the article by Western Editor E. W. Schrader on page 8. Here in one article Editor Schrader has described several design ideas, all of which are an outgrowth of a well-administered value engineering program. Some really dramatic cost savings are shown which are traceable to design.

The guest editorial on the opposite page represents another slight departure from our usual format. R. E. Meyers is head of the value group at the San Francisco Naval Shipyards. It can be said in all honesty that he is in great part responsible for the entire program of value engineering and design at this shipyard. It also can be said that he is responsible for the cost savings that have been achieved.

All too often value engineering programs end up as value analysis programs. Automatically this means a definite limitation on the amount of savings that can be achieved. Value analysis can be thought of as a program of "after the fact" critique of existing designs. As such it is often resented by the designers and the production engineers alike.

On the other hand, value engineering starts with the designer. It is a concept which every designer would do well to consider at the initial stages of every design.

Why have we made these exceptions in our usual format? Actually they are not really exceptions. DESIGN NEWS exists for the sole purpose of stimulating design thought through the presentation of design ideas. I think Mr. Meyers' editorial is thought provoking. I also think the article by Ed Schrader is equally thought provoking.

Why not try the "value engineering" approach on your next design?

*J. P. Dubois*

Executive Editor



'Jeep' Industrial Engines power high velocity tree sprayers.

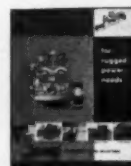
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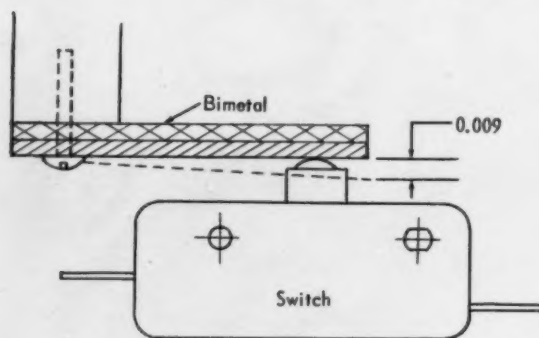
## Design Specifications for Snap-Action Switches

James U. Dernehl, Vice President, Cherry Electrical Products Corp., Highland Park, Ill.

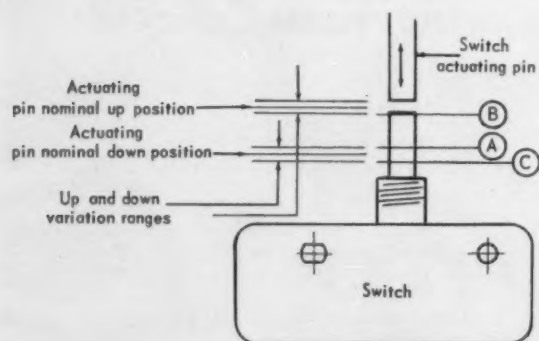
The meeting ground for the switch manufacturer and the switch user is in the switch specification. Unfortunately, specifications, as conventionally written, often tend to eliminate rather than encourage the greatest number of switch proposals.

The following will illustrate some of the areas in which the designer's needs are not communicated to the switch manufacturers:

1. When the movement to operate a switch may be limited—by bimetal actuation, for example:



2. When the movement which operates a switch may vary; the drawing shows common manufacturing tolerance ranges, unit-to-unit:

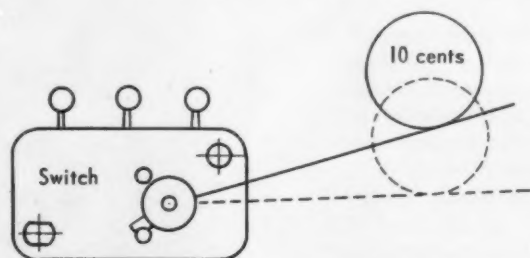


A. switch must operate when pressed to only this point,

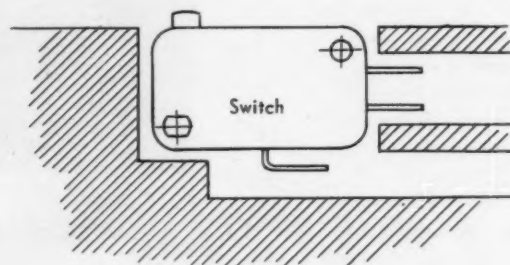
B. switch must reset when released to only this point, and

C. switch must not be damaged if pressed to this point.

3. When the force available to operate a switch may be limited by the weight of the actuating object—a thin 10-cent piece (2 grams), for example.



4. When space available for a switch may be limited.



In each of the first three cases the switch application is different, yet in each the switch movements and forces must be coordinated with the movements and forces of a mating mechanical member. Also, normal manufacturing tolerances cause unit-to-unit variations in movements and forces of this member. The switch must somehow accommodate these variations.

Normally, the design engineer will try samples of several snap-switches in his application and, once having found an acceptable switch, will make a drawing of it. Dimensions, forces, movements and electrical specifications are generally taken from the catalog of the manufacturer. This drawing then is sent to various other switch manufacturers by the purchasing department of the company in question.

The implication of this drawing is that only those precise characteristics of the switch drawn will be acceptable. But the fact is that almost no two snap-switches from different manufacturers have

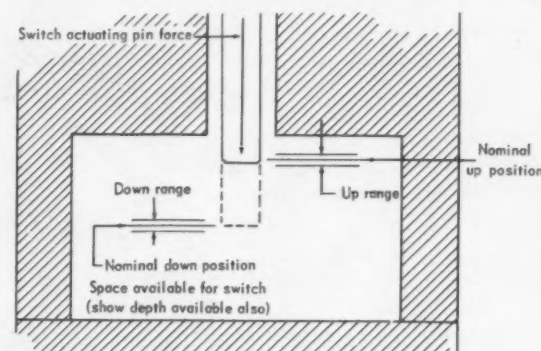
the same characteristics. Design preferences beginning with the internal switch mechanisms cause the dissimilarities. Further, these precise characteristics are seldom really needed.

For example, the switch the design engineer has drawn might have an operating force of 6 oz while the member which actuates the switch actually provides 12 oz of force. Or, the switch drawn might have a movement differential of 0.005 inch, while the actuating member moves 0.030 inch. The switch manufacturers (other than the manufacturer of the switch drawn) who receive this drawing might not submit sample switches that actually are well suited to the application because they appear to exceed the movement and force limitations.

This illustrates the need for better communications to the switch manufacturers on what the design engineer actually wants rather than a description of the stock switch that most nearly meets his requirements. Eventually, a drawing of the switch will become necessary, but, initially, a drawing could discourage switch proposals rather than promote them.

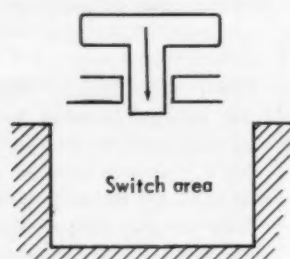
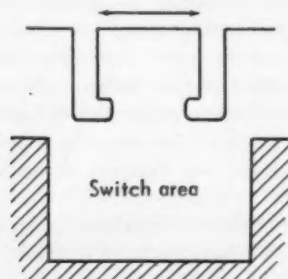
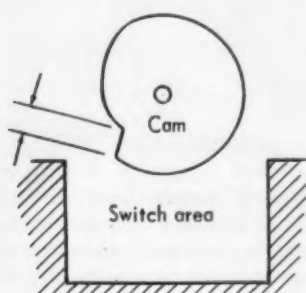
There are four basic pieces of information that a snap-switch manufacturer would like to have on a switch before submitting a proposal. This information should be submitted in terms of the actual application rather than in the form of a specific switch that was found to work. They are:

1. Movement available to operate a switch,
2. Force available to operate a switch,
3. Space available for a switch and
4. Electrical load the switch must handle.





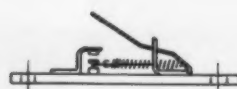
The actuating member might vary greatly but it also should be shown in a sketch, complete with critical dimensions concerning movements.



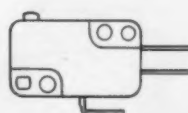
Other essential considerations the switch manufacturer would like to know are:

1. The switch pole and throw arrangement (SPDT, DPST, etc.).
2. The electrical and mechanical life required (they are not always the same).
3. General application, description and environmental conditions—moisture, atmosphere, contamination.
4. Approvals required—U.L., military.
5. Switch volume—very important for analysis of quality of tooling required.

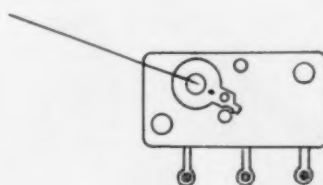
Finding the right snap-action switch and arriving at the best quality/price combination is largely a matter of providing the switch manufacturer with good data. Each manufacturer has an applications engineering department that is anxious to translate this data into a switch proposal—at no cost to the prospective purchaser. The design engineer who takes the time to prepare and circulate clear and concise switch specifications will be surprised at the variety and extent of switch proposals he will receive.



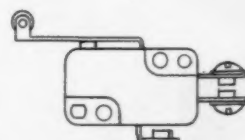
Open-type switch



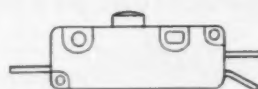
Miniaturized basic switch



Feather-touch switch



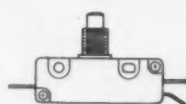
Cam-follower switch



General-purpose basic switch

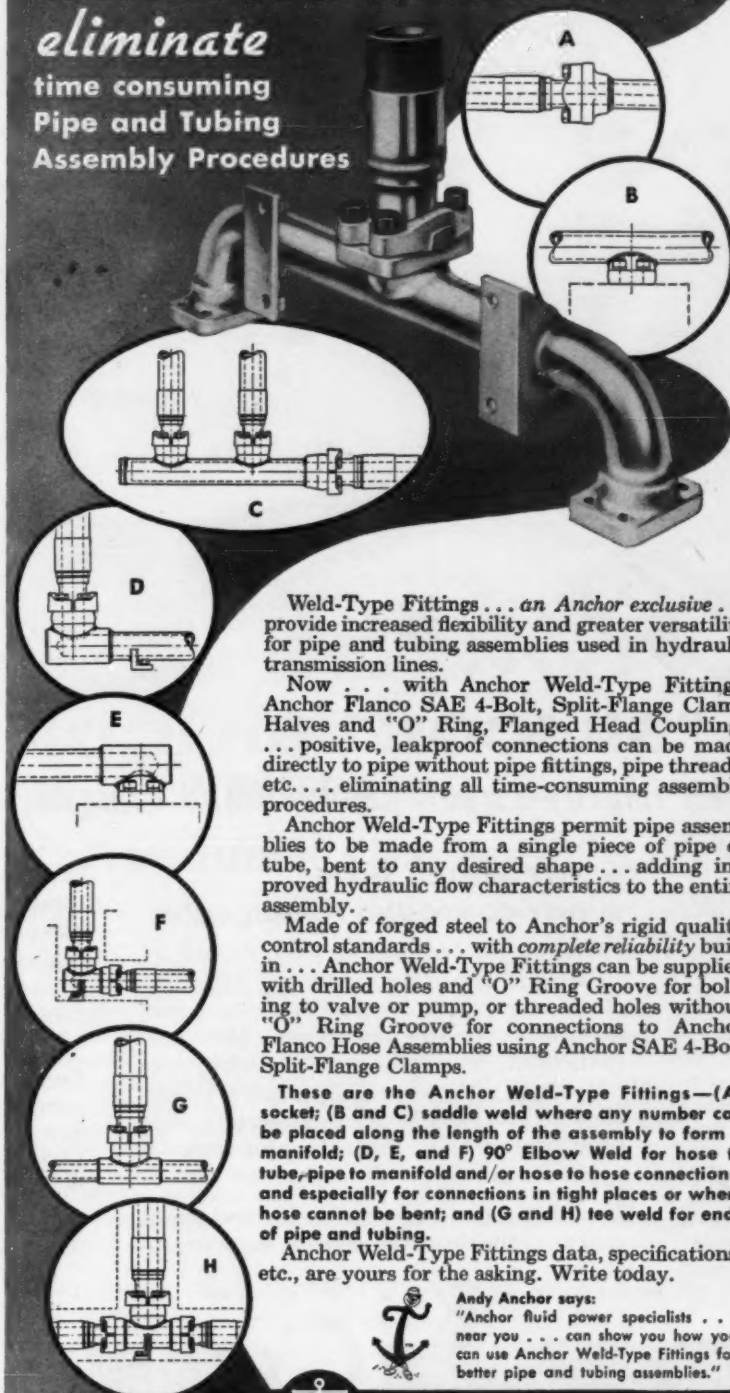


Reset switch



Pushbutton switch

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Weld-Type Fittings . . . an Anchor exclusive . . . provide increased flexibility and greater versatility for pipe and tubing assemblies used in hydraulic transmission lines.

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**SEEN AND HEARD**

**ART FORM AND DESIGN IDEA**

Edward W. Schrader, Western Editor

**"AN INDUSTRIAL DESIGNER**

is a creative artist with knowledge and understanding of engineering; he must know the abilities and limitations of material, mass production processes, marketing requirements. He must have a keen understanding of consumer tastes, desires and needs. And he must be cost conscious." So says the brochure of the Industrial Design firm of Merendino/Greene and Associates, Inc., Pasadena, Calif.

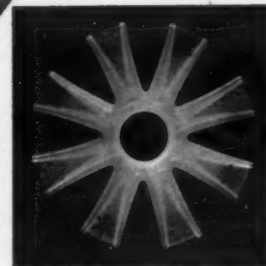
These fine words offer rationalization to management when employing the services of an industrial designer. But what do the words mean to the engineer, the designer or the plain guy at the board?

Succinctly stated, a designer creates a product which can be manufactured and sold at a profit.

This brief definition is all-encompassing. Perhaps it is so brief that we miss the significance of the statement.

**PRACTICAL DESIGN IDEAS**

are created, whether they be function-centered or appearance-centered. The better design will be a balanced and an economical combination of both. But because the success of a corporation rests on the design engineer's ability to create, he must remember the entire definition.





The usual concept of Industrial Design is one of artists doing mechanical design rather than mechanical designers working with the art form. Should it be any more difficult for the blend to occur from one direction than from the other? It can be done as evidenced in the following example: a case history where the Industrial Design firm conceived, designed, developed and engineered for production a product which brings together mechanical design and art form.

#### A SKI POLE

developed by Merendino/Greene for Sila-Flex, Costa Mesa, Calif., is an easily understood example of art form and design idea in the consumer goods field.

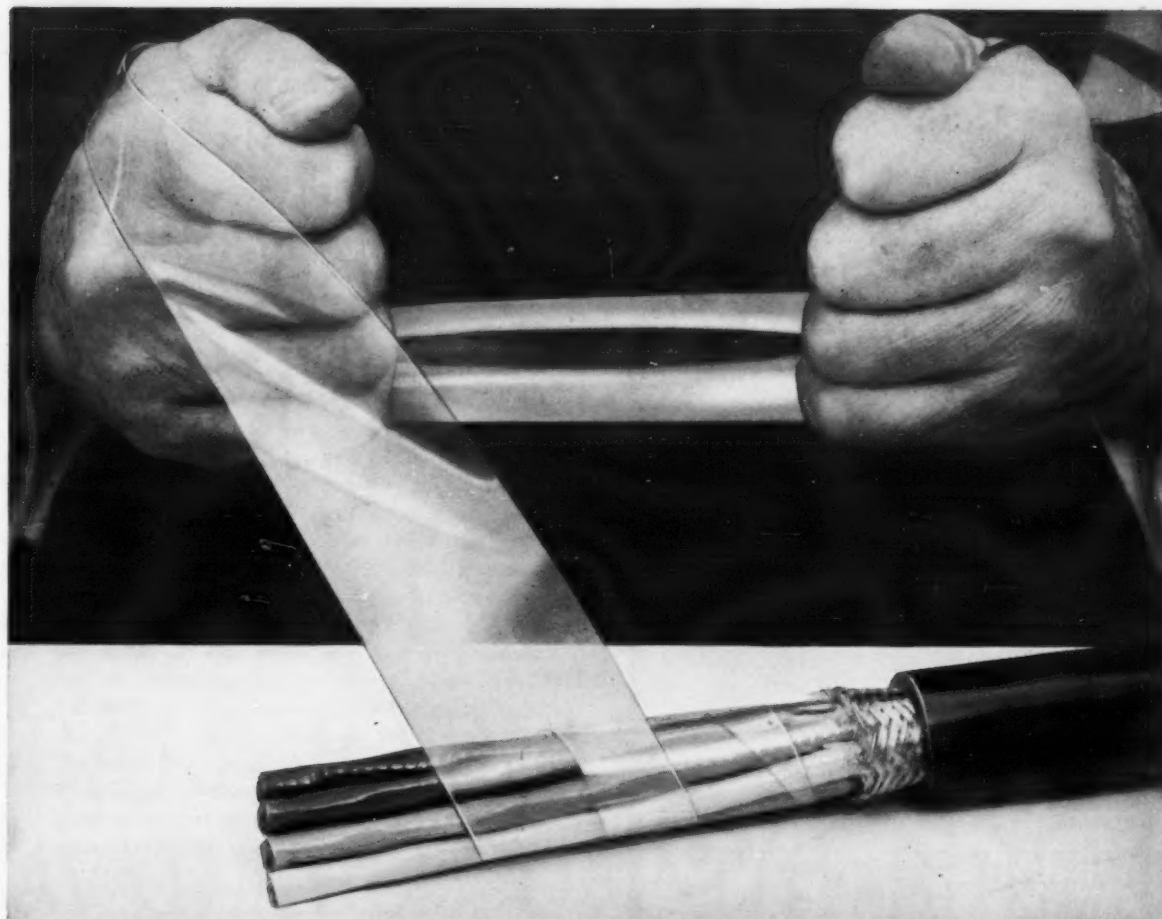
The need for the design was caused by a manufacturing and marketing capability of a firm, already engaged in producing fishing rods of tubular "Fiberglas" laminate. Surely there is no shortage of ski poles, but in this case, there was a need to utilize a manufacturing facility and its outlets.

The snowflake basket eliminates the usual ring for an improved art form and for a practical design. The ring basket can snag on trees or bush branches, jerking the pole from the skier's grip and possibly causing shoulder dislocation. The snowflake pattern, 4 inches in dia, presents more bearing surface to the snow than the conventional ring basket, 5 inches in dia. The grooves on its bottom surface give greater traction, and the top surface is decorated with heat foil embossing, permanently embedded in the plastic.

The basket is free to move on a ball swivel. It can be snapped on or off the ball swivel under force.

On the opposite end of the pole, a large-diameter, fine-threaded screw secures the leather strap. After the strap is adjusted for length to fit the user, the screw is tightened down.

In the case of the Magnum Ski Pole, who is to say whether the strap on one end and the snowflake basket on the other end of the pole is a design idea or an art form? The designer must have had a knowledge of both mechanical design and art form. He successfully created a product which could be manufactured, could be sold and could be profitable.



## Tough tape of MYLAR® cuts cable costs . . . reduces size, weight

Can the unique combination of properties found in "Mylar" help solve your design problems?



**Tensile strength of 20,000 psi . . .**  
Bowling-ball test offers dramatic proof of the amazing strength and toughness of "Mylar" polyester film.

"Mylar"® polyester film is a tough, flexible engineering material. Used as a core binder tape for electric cable, "Mylar" prevents sharp braid wires from puncturing the primary insulation during cable manufacture. Replacing heavier, thicker materials formerly used, "Mylar" reduces size, weight, cost of cable.

In addition to its average tensile strength of 20,000 psi, "Mylar" has excellent resistance to most chemicals and moisture, a dielectric strength of 4,000 volts per mil for 1 mil film, and can withstand temperature extremes from -60° to 150°C.

On an area basis, tough, thin "Mylar"

often costs less than heavier, conventional materials. "Mylar" can be laminated, embossed and metalized, punched or coated. The film won't become embrittled with age. "Mylar" is available in roll or sheet form in a wide range of gauges.

Find out how the combination of properties in "Mylar" can help you solve knotty design problems, improve product performance or cut costs. Write today for our new booklet containing detailed information on properties and applications. E. I. du Pont de Nemours & Co. (Inc.), Film Dept., Room #8, Wilmington 98, Delaware.

\*\*\* "Mylar" is Du Pont's registered trademark for its brand of polyester film.



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BETTER THINGS FOR BETTER LIVING  
...THROUGH CHEMISTRY

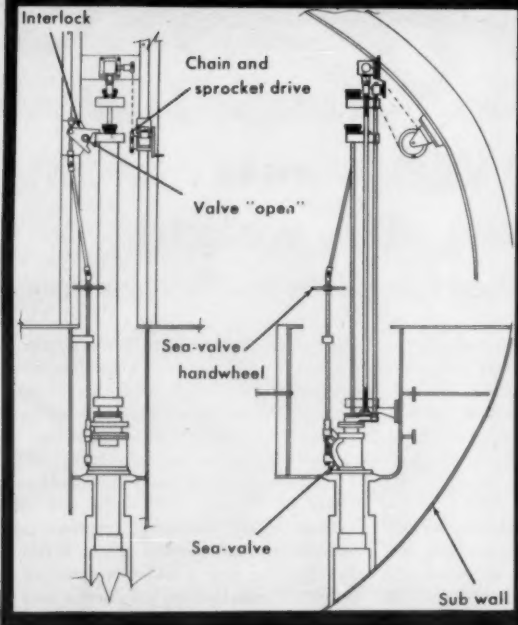
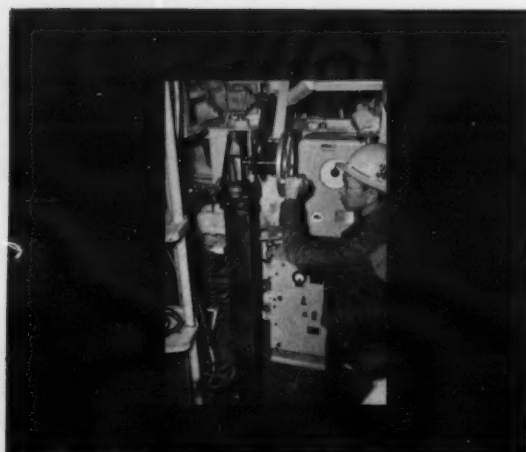
**DU PONT**  
**MYLAR**  
POLYESTER FILM

Circle 7 on Reader-Service Card for more information



## Value Engineering Applies Design Ideas

Edward W. Schrader, Western Editor



**BALL SCREW WITH MECHANICAL INTERLOCK** moves rod/meter under water log through sea-valve packing gland in 3 minutes versus 40 minutes in original design at cost saving per submarine of \$6,750. Chain drive on handwheel permits location in various configurations. Right-angle gearbox turns screw to raise and lower rod/meter through packing in sea-valve. Second handwheel opens and closes sea-valve, and by means of jointed rod and screw, it pivots latch to interlock rod/meter movement with sea-valve position.

Value engineering, defined as an engineering approach to cost reduction, is the application of design ideas to a product. Production engineering usually cannot reduce the cost of a product by more than 20 percent, since this approach is limited to manufacturing techniques. But design engineering, with value in mind, can reduce the cost of a product as much as 80 percent. The design engineer controls the cost of a product more than any other person.

Value engineering, too often applied "after the fact", has made impressive cost reductions in the Naval Shipyards. Savings-to-cost ratio in 1960, for example, was about 16:1.

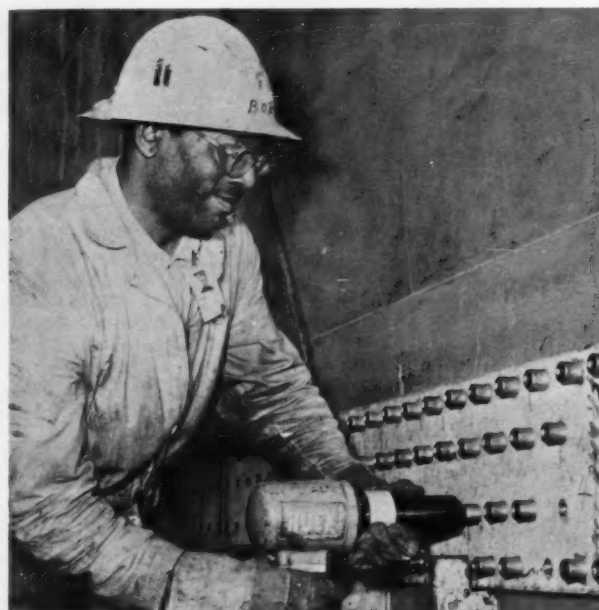
Many designers suffer from "functional fixation". The designer is concerned primarily with product performance. The value engineer is concerned with cost and maintaining performance. The two can be,

and at times are, combined by resourceful individuals using unique and unusual design ideas.

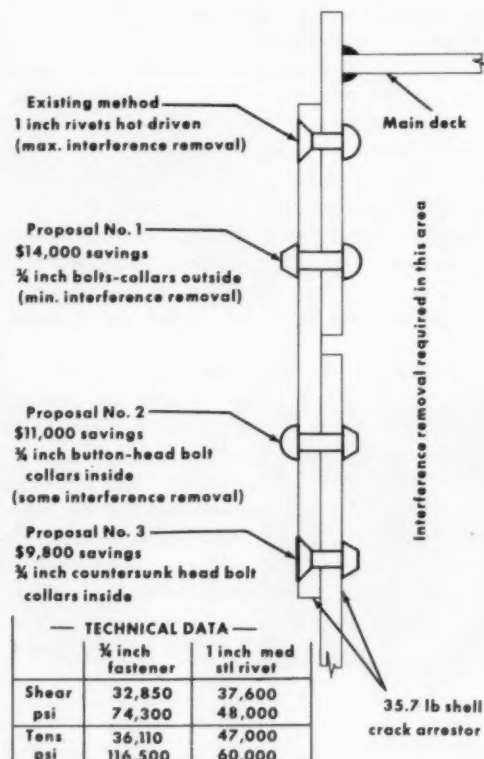
The entire value engineering branch of the U. S. Navy Bureau of Ships consists of 40 engineers. At the San Francisco Naval Shipyard, the 3-man team has instituted many cost-reduction design changes. Some of their design ideas are presented here to stimulate designers in other fields.

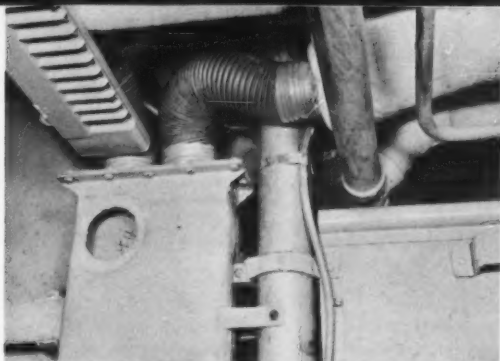
The ideas range from nut and bolt changes to major redesign. The blast technique is always the first approach—eliminate the part completely if at all possible.

This approach removed the aft torpedo outer shutter doors on Portsmouth-type submarines. Cost of mechanical and structural repairs was excessive. To avoid submarine detection, a large amount of repair work would have been required to eliminate door rattle.



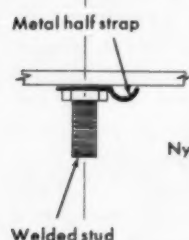
**CRACK ARRESTER** is 7/8-inch-thick plate joining hull sections with commercial fastener in place of hot rivets. Each fastener costs more than rivet, but savings are in manhours to install plate. Cost reduction for 251 ft of crack arrester is \$7,622.



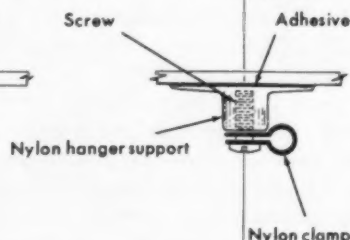


**FLEXIBLE VENTILATION DUCTING** replaces fabricated sheet-metal circular ducting when special fittings and transition are required to clear interferences in individual or branch circuits. Helical-wound wire reinforces neoprene-impregnated fabric with only slightly more pressure loss than fabricated ducting. Savings are \$7,745 per ship.

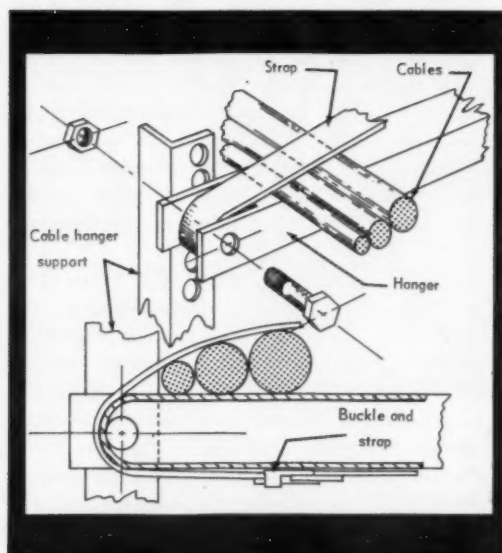
#### PREVIOUS DESIGN



#### REDESIGN



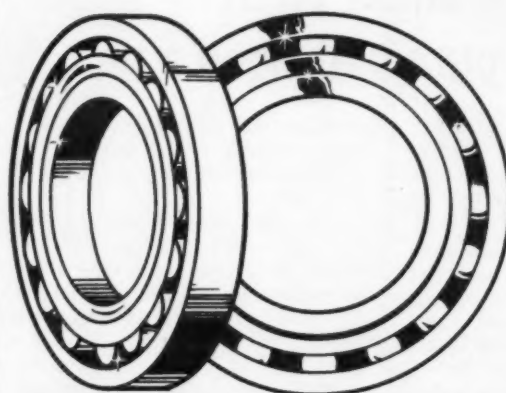
**NYLON HANGER SUPPORT** replaces welded stud for electrical wiring and small tubing. Adhesive bonds new support with nylon clamp to bulkhead. Unit cost reduction is \$0.49 for estimated total yearly savings of \$4,900.



**CABLE HANGER** of square tubing with sheared and rolled ends replaces ferrules for round ends under steel banding. Redesign allows buckle on steel strap to be placed against metal hanger instead of on top of cable bundle. Savings accrue because of eliminated parts and reduced manhours to strap cable bundle. Yearly savings are estimated to be \$43,300.

# NEWS!

## KAYDON NOW REDUCES PRICES ANOTHER 25% TO 42% FOR "CP" BALL RADIAL BEARINGS AVAILABLE "OFF-THE-SHELF"



Low prices are also being quoted on many other ball and roller bearings ...both standard (4" bore and larger) and special (2" bore and larger).

You can now save on many of your current and future purchases of these bearings.

Send your inquiry now! Write, wire, or call Kaydon, Muskegon, Michigan. Phone: PLaza 5-3741.

K-619



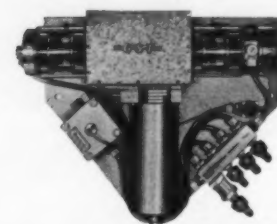
THE **KAYDON** ENGINEERING CORP.  
• MUSKEGON, MICHIGAN

All types of ball and roller bearings — 2" inside diameter to 178" outside diameter . . . Taper Roller  
Roller Thrust • Roller Radial • Needle Roller • Ball Radial • Ball Thrust • Four-Point Contact Bearings

Circle 8 on Reader-Service Card for more information

## Pressure Transmitter

R. F. Stengel, German Editor



A control element automatically generates a pressure signal in the 3-15-psi range that is proportional to the product of two incoming pressure signals in the same standardized range. The element is designed as one component in a series of units for automatic process control.

To perform the operation  $(X)(Y) = Z$ , a mechanical linkage, consisting of three subgroups and acting as pressure transmitter, is employed. The first subgroup is attached to a membrane chamber which receives a pressure signal representing the factor X. Changes in membrane deflection are transmitted through a linear-motion linkage which terminates in an arm capable of rotation in one plane and carrying a roller at its free end.

The roller remains in contact with a circle segment which rotates around one end and is linked to the third subgroup approximately at its midpoint. The contact point of roller and circle segment is shifted by the second subgroup of the linkage, which terminates in a spring-loaded bellows under a pressure representing the factor Y.

Depending on the magnitude of Y, a displacement of the first subgroup corresponding to the magnitude of X results therefore in a greater or smaller rotation of the circle segment, which in turn, through a linear-motion linkage, actuates a membrane chamber in which the pressure represents the output signal  $Z = (X)(Y)$ .

The restoring force on the output membrane is provided by a combination of a nozzle, impact plate and pneumatic amplifier, which is supplied with an operating pressure of approximately 17.5 psi. The operation begins when both X and Y signals are at least 3 psi.

The pneumatic multiplier RRG-M is a product of Gesellschaft fuer Selbsttaetige Temperaturregelung Schellhase & Co., Berlin-Wilmersdorf, Germany.



## How only 5 men and a small plant produce 15 million cubic feet of pure hydrogen a month

Nickel stainless steel permits unique plant design for new low-cost cryogenic process. What's so unusual about this Van de Mark hydrogen purification plant in Linden, New Jersey?

**First, at a low capital investment of about \$200,000**, it has handled the purification of a neighboring refinery's off-gas hydrogen for 2½ years with no "downtime" and minimum maintenance. Only 5 men are needed to keep the plant going.

**Second, the plant produces low-cost, pure hydrogen** through a cryogenic process. Impurities are removed through fractional condensation when the hydrogen is cooled to

-320 F. At this point, most other gases become liquid—yet the hydrogen remains a gas—permitting the liquids to be removed by means of absorbent beds and molecular sieves.

**AISI Type 304 Nickel stainless steel** was selected as the most practical and economical material for the absorbers, molecular sieves, and interconnecting piping. Strong and tough even far below -320 F, these Nickel stainless steel components are sealed away out of view... and away from the maintenance that simply isn't needed.

Type 304 is just one of the Nickel-containing steels that can withstand the damaging effects of super-cold... and at the same time offer the strength, toughness, and corrosion

resistance that protects the purity of many a process stream. Ready availability plus fabricability are an added advantage.

If your operations involve low temperatures (even -454 F) get the facts on how the Nickel-containing steels can go to work for you at practical cost. Write to Inco describing your metals requirements.

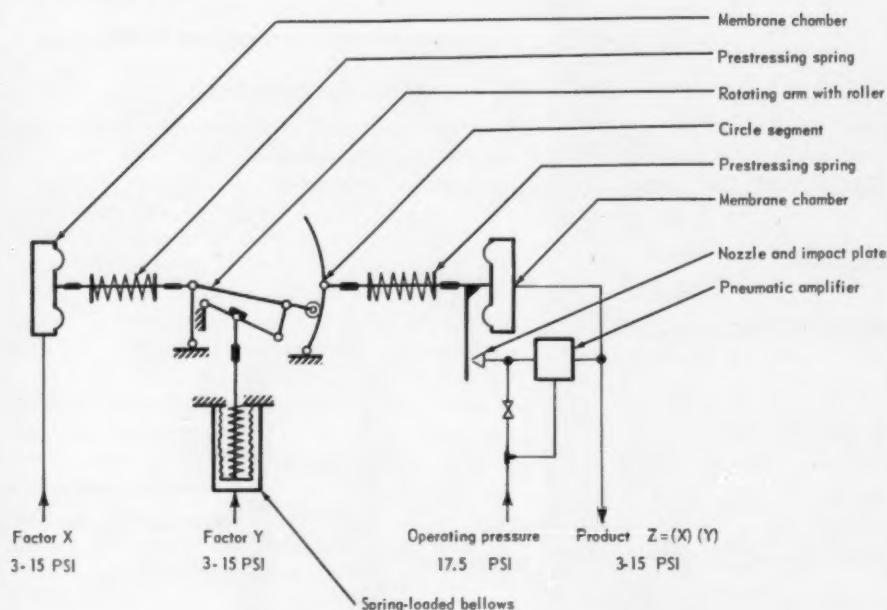
THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street  New York 5, N. Y.

**INCO NICKEL**  
MAKES STEELS PERFORM  
BETTER LONGER



## Performs Pneumatic Multiplication



## Angular Drive Design

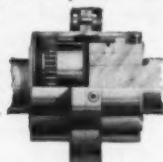


## Made Possible with

AJAX Dihedral Couplings with a wide range of angular and offset capacities provide smooth running angular drives with constant peripheral speeds in minimum space. Results include compact size, improved performance, elimination of breakdowns and reduced maintenance cost. Write for performance data.

# AJAX

FLEXIBLE COUPLING CO. INC.  
28 Portage Road  
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# DIHEDRAL COUPLINGS

Representatives in  
Principal Cities  
See Yellow Pages

Circle 10 on Reader-Service Card for more information

## Chace THERMOSTATIC BIMETAL

Actuates Another  
Precision Product

## RBM Electric Blanket Control

RBM Control Division  
Essex Wire Corporation  
Logansport, Indiana



Sleep, sleep, sleep... cozy, warm, comfortable. Room temperature and outside weather conditions have no effect on slumber when electric blanket temperature is governed by the RBM Blanket Control. Set it, then forget it... night after night... year in and year out. The RBM Electric Blanket Control assures comfortable, trouble-free sleeping conditions.

The thermostat control element is made up of three legs of thermostatic bimetal; the outside two are the deflection members and they are in compression. The center leg is in tension and is controlled by screw adjustment. This friction-free bimetal element is capable of closely holding temperature differential, even though it is of snap-action type.

This very successful and unique control is actuated by dependable Chace Thermostatic Bimetal. Chace is recognized the world over as the leader in the manufacture of thermostatic bimetal for snap-action elements. This fine Essex Wire product and many other controls lean heavily on the dependability of Chace Thermostatic Bimetal. This dependability is born of more than a third of a century of specializing in the manufacture of precision thermostatic bimetal; our only product. When you specify Chace, you specify dependability.

*Send Now For Our New "Information Booklet"!*

It contains many well illustrated pages of valuable design data and examples of successful applications of bimetal! More than 40 types of Chace Thermostatic Bimetal are available in coils, strips and completely fabricated elements of your design.



**W. M. CHACE CO.**  
Thermostatic Bimetal  
1612 BEARD AVE., DETROIT 9, MICH.

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**For  
wide capacity range...**

**DE LAVAL**



**power-hydraulic  
pumps**

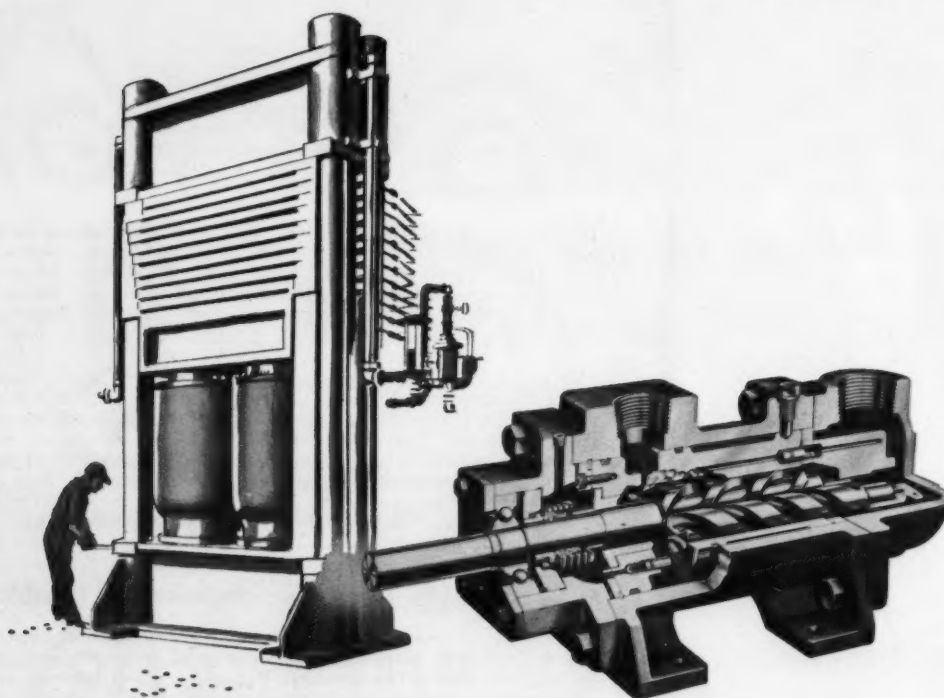
A single IMO pump can deliver up to  
3000 gpm at 300 psi  
1000 gpm at 500 psi  
400 gpm at 3000 psi

The wide range of volume and pressure capabilities of IMO pumps finds extensive use in hydraulic-press applications. These, as a rule, require high capacities at low to medium pressures for pre-fill service, then low capacity at high pressure during the working part of the stroke.

Versatile IMO pumps deliver maximum performance in many varied power-hydraulic applications. Besides wide capacity range, IMO pumps offer non-pulsating flow, quiet operation, high speed and reliability... even with fire-resistant fluids. Compact design saves expensive floor space. Installed cost is lower than for other types of pumps. IMO pumps cut maintenance, too... only three moving parts!

For application and performance data, selection information, dimension drawings and tables, write for Bulletin IM-3200.

De Laval Steam Turbine Company, Trenton 2, New Jersey.



**DE LAVAL • 60 YEARS OF CREATIVITY AND QUALITY**

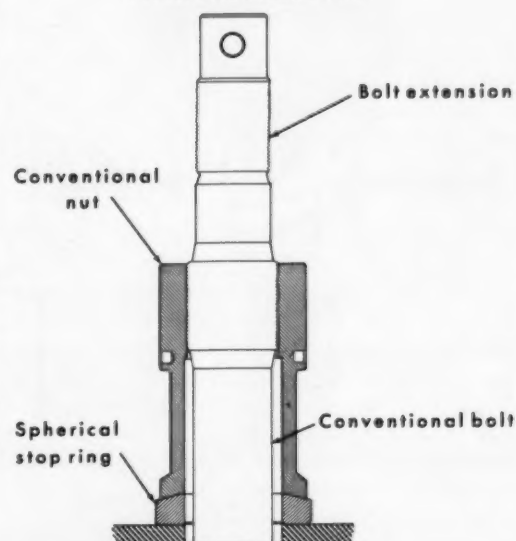
CENTRIFUGAL PUMPS AND COMPRESSORS • TURBINES • IMO® ROTARY PUMPS AND HYDRAULIC MOTORS  
MARINE PROPULSION AND AUXILIARY EQUIPMENT • HELICAL AND EPICYCLIC GEARS • TURBOCHARGERS

IDEAS...MECHANICAL

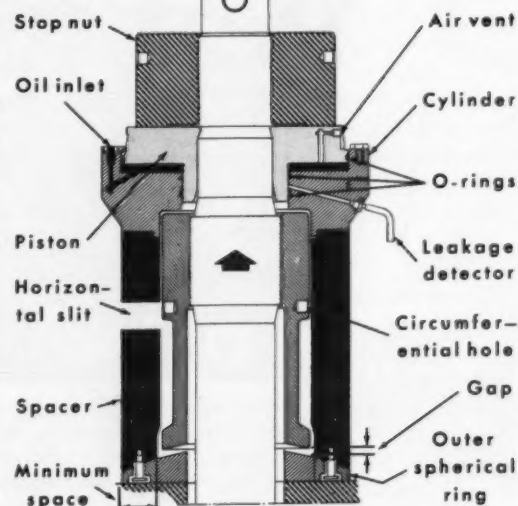
## Spacer Permits Removal of

Volrath Holmboe, Correspondent in Sweden

### TENSIONER REMOVED



### PRESSURE APPLICATION



HYDRAULIC TENSIONER consists of piston, cylinder, stop nut and spacer. Spacer surrounds conventional nut to form platform for piston and cylinder. Stop nut is spun down to top of piston. Application of hydraulic pressure lifts piston with stop nut and extends bolt, releasing conventional nut. By spinning conventional nut to close gap, tension in bolt is maintained after release of pressure.

EM-DE-108

## Hydraulic Bolt Tensioner

Introduction of a spacer permits a redesigned hydraulic tensioner to act directly on a bolt extension, independently of the nut. Compared to the original design where the tensioner was built into the nut itself (DESIGN NEWS, April 10, 1961), the redesign permits removal of the tensioner after use for application on any number of bolts. Diameter of the remaining parts is reduced by removal of the tensioner, permitting closer bolt spacing. Replacement of the threaded piston extension by a stop nut is more convenient, since the piston does not have to be rotated.

The new hydraulic tensioner was designed by Svenska Kugellagerfabriken, Gothenburg, Sweden, for tightening the pressure tank cover in the Swedish 65 MW reactor R3/Adam, which will start operation in 1962. The tank will be sealed by 48 bolts which, by means of 16 tensioners, will be tightened to 450 tons per bolt in three stages. Bolt diameter is 0.125 m and length is 2.06 m.



**HORIZONTAL SLIT** in spacer provides access to conventional nut. Spherical stop ring permits some angular misalignment of bolt. Outer part of spherical ring is removed together with tensioner to keep remaining diameter to a minimum. All parts are of stainless steel.

I'm all burned up...

**WATLOW'S**  
horning in on  
my business

Yes, heat is our business too. When you need a devil of a lot of it in small space there's nothing like a Watlow FIREROD Cartridge.

There's a Watlow Electric Heating Unit for most applications, or we will custom design it for you. Catalog 137 will give you the complete facts on Cartridge • Strip • Immersion • Cylindrical • Tubular and Flexible Silicone Rubber Electric Heating Units.

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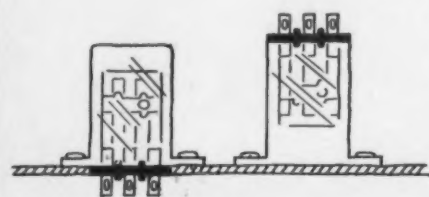


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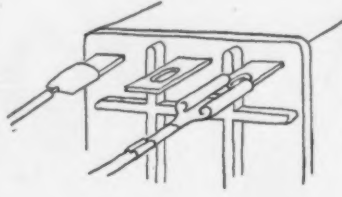
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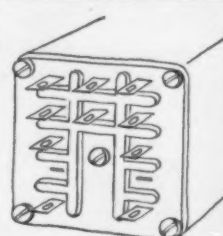
# FRESH IDEAS IN RELAYS...



**CHOICE** of below-chassis or above-chassis connecting in plastic enclosures.



**MULTI-USE** terminals allow soldering, insertion in printed circuit board, and use of AMP Style 110 push-on terminals.



**ALL TERMINALS** on one panel... permits insertion in printed circuit board.

## SPECIFICATIONS

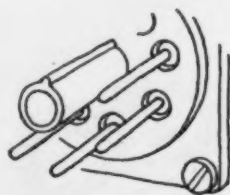
**CONTACTS:** Integral with terminals; up to 3PDT; 5 amp, 115 VAC or 32 VDC. Stationary contacts, fine silver inlay material; movable, solid fine silver.

**COILS:** Up to 230 VAC at 60 cps or 115 VDC.

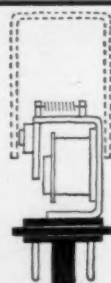
**ENCLOSURES:** Clear plastic.

**TERMINAL PANELS:** Barrier type or octal plug.

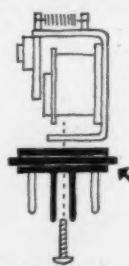
**LATCHING RELAY:** Available enclosed in clear plastic with plug-in mounting; or unenclosed.



**OCTAL PLUG** relays up to DPDT have recessed pin bases... meet UL spacing requirements to 150 V.



**ALL ENCLOSED** relays mount solidly on base... not on covers.



**INTEGRAL** plug-in base up to DPDT avoids wiring between contact terminals and pins.

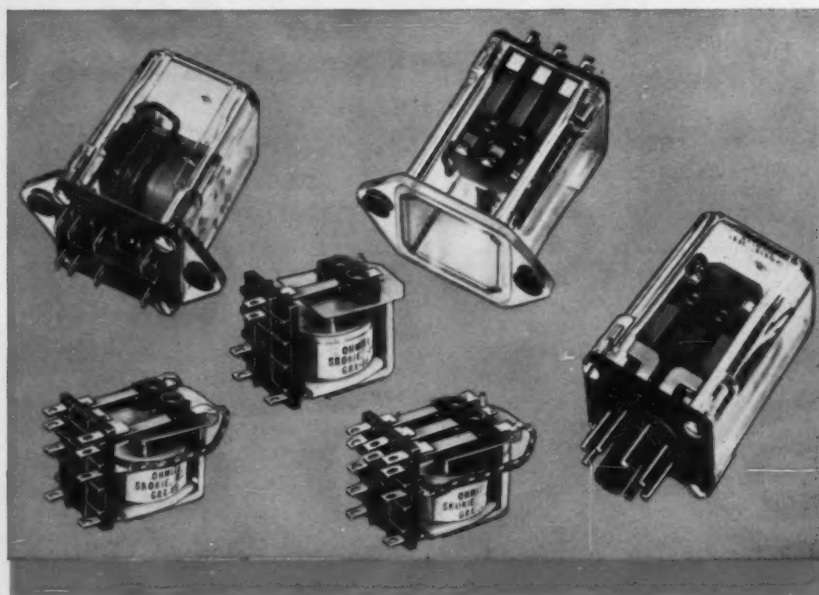
# OHMITE'S New "GR" Series

Stocked for Immediate  
Delivery From  
Distributors or Factory...  
WRITE FOR BULLETIN 166



**OHMITE MANUFACTURING COMPANY**  
3816 Howard Street  
Skokie, Illinois

Rheostats • Power Resistors  
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Variable Transformers  
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Micromodules • Relays  
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## IDEAS...MECHANICAL

### Closure Device

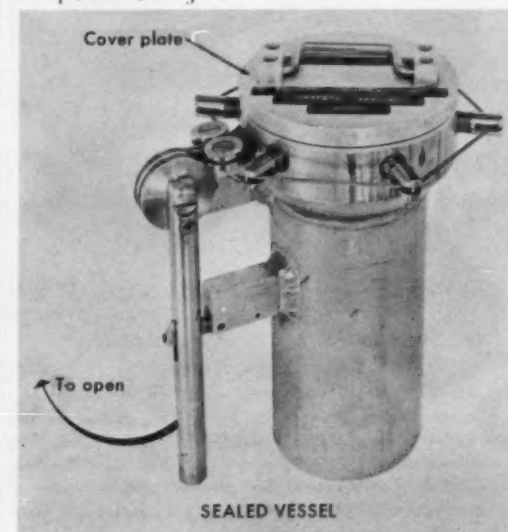
Victor W. Wigotsky, Eastern Editor

A quick-opening closure uses the internal pressure acting against the cover plate to wedge a group of tapered pins into a machined groove. Unit requires only 1 sec to either seal or open a pressure vessel, thus permitting quick access when desired. Method avoids necessity of comparatively tedious tightening and loosening of bolts.

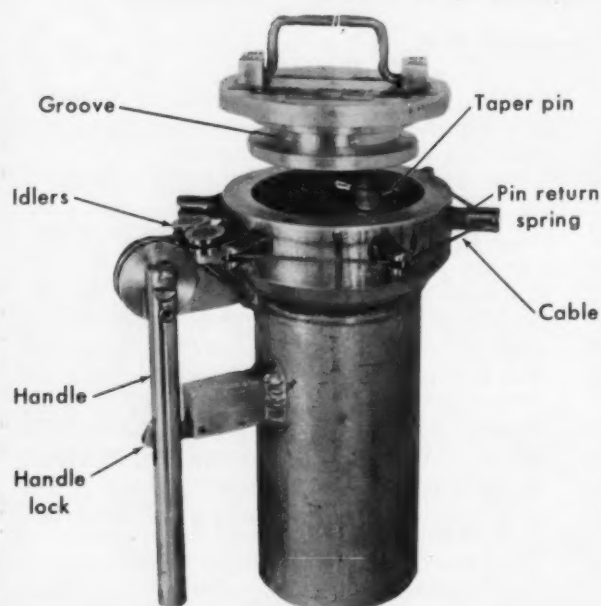
The tapered pins are positioned for the wedging action by a stainless-steel cable which passes through each shank. When tightened by the motion of a handle, the cable exerts an equal inward force on all the pins. The pins then wedge themselves into a groove in the cover when pressure is applied in the vessel. Wedging action seals the cover plate to the pressure vessel's neck flange. Since internal pressure acts as a positive locking element, it is necessary to relieve it before the cover can be removed.

The speed of opening and closing is achieved simply by manipulation of the handle connected to the cable through idler pulleys. A preload force applied to a spring on each tapered pin during locking action then is used to release the pins outwardly when the handle releases the cable acting against the pins.

The quick opening and closing device has been tested and accepted by Brookhaven National Laboratory of the AEC, in connection with its Cobalt-60 food radiation research. Unit was designed by H. C. Cusumano of Process Equipment Corp., Lodi, N. J.

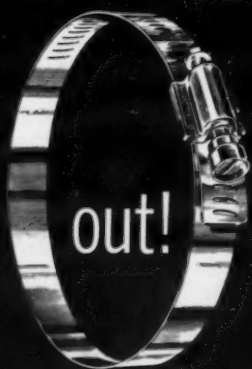


## Uses Vessel's Pressure as Locking Force



CABLE encircles through equally spaced tapered pins around circumference of pressure vessel. Downward motion of handle causes tightening of cable and inward, uniformly distributed pressure on each pin. Cover plate then is sealed to neck flange by wedging of each tapered surface in machined groove. Internal pressure must be removed to release wedging force. Lever arm then is pivoted upward, causing slack in cable and release of preloaded spring force. Outward movement of pins permits removal of cover. Unit is ASME-code approved.

one  
stands  
out!



### AERO-SEAL JET® WORM DRIVE HOSE CLAMP

Designers know that sometimes even a relatively simple device is almost impossible to imitate, and AERO-SEAL has proved this point in the hose clamp field. The patented AERO-SEAL JET, for example, provides all of the advantages—including the security—of a precision worm drive clamp, yet permits almost instantaneous installation or removal. And AERO-SEAL bands and housings are of 302-18-8 stainless steel. All stainless also available.

AERO-SEAL solves countless fastening problems in electrical appliances, electronic, and chemical equipment. Complete range of sizes from 7/16" to 15 feet. Ask your industrial jobber.

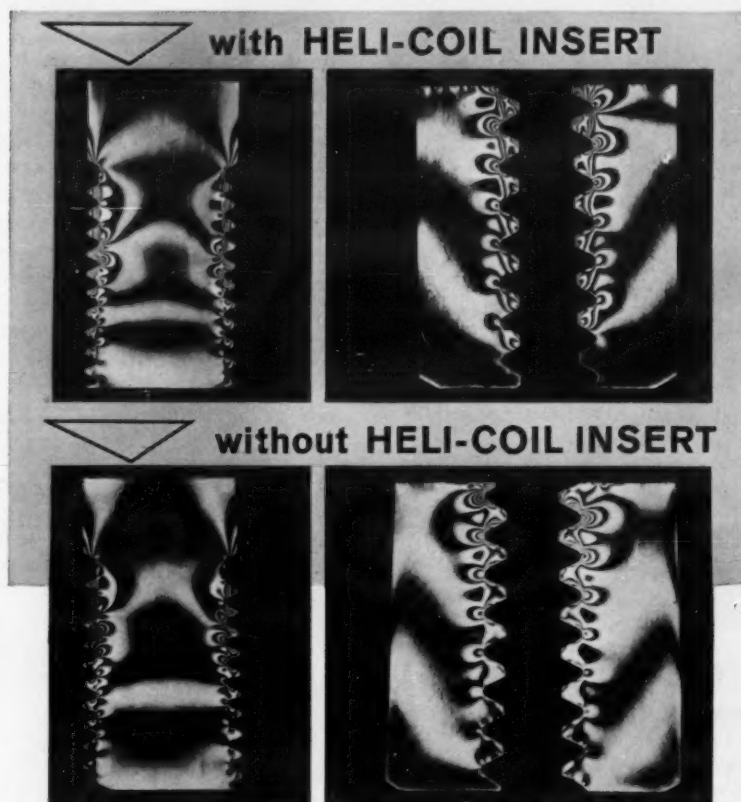


**BREEZE CORPORATIONS, INC.**

700 Liberty Avenue, Union, N.J. • Cable Address: Breeze, Union, N.J.



## How HELI-COIL® Stainless Steel Wire Inserts Eliminate Stress Concentration and Insure Maximum Strength in Threaded Assemblies



Made of stainless steel wire, precision-rolled to a diamond-shaped cross-section, **Heli-Coil** screw thread Inserts provide two exclusive characteristics directly related to threaded assembly strength:

1. **Permanent, resilient threads between the threads of the male and female assembly members.** These eliminate stress concentrations (upper photos) by distributing the load evenly along the full length of thread engagement in both members. By contrast, note the sharp stress concentrations (lower photos) around the first two threads of the conventional assembly.

NOTE: Diagrams at right show how **Heli-Coil** Inserts compensate for lead and angle error between female and male threads.

2. **A superior surface finish (8-15 RMS).** This holds friction loss to a minimum and, thus, provides maximum, consistent clamping load at any given wrench torque load.

**RESULT:** No stress concentration; improved fatigue strength in the male member; and a stronger assembly under all conditions.

There is a complete line of **Heli-Coil** products for every thread need: inserts, taps, tools and gages. Let us help with your design and application problems. Write today for complete information.

3146



**HELI-COIL CORPORATION**

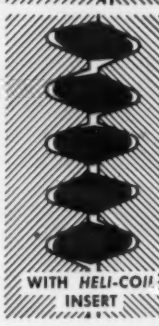
3311 Shelter Rock Lane, Danbury, Conn.

In Canada: ARMSTRONG BEVERLEY ENGINEERING LTD., 6075 Jeanne Mance St., Montreal 15, Que.

SCREW THREAD  
ENGAGEMENT



CONVENTIONAL



WITH HELI-COIL  
INSERT

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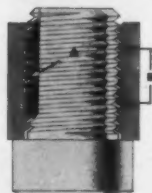
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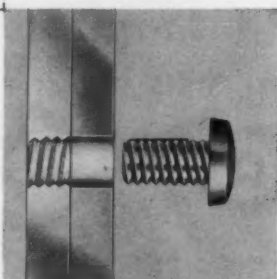
This is a **LONG-LOK Self-Locking Screw**. It is a one-piece reusable fastener, heat, vibration, impact and shock resistant.



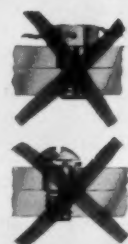
It is vibration resistant because the resilient, reformable insert (A) acts as a wedge between the male and female threads, causing a metal-to-metal drag (B).



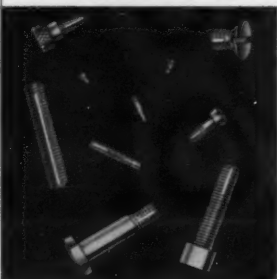
**LONG-LOK Self-Locking Screws** are flush protruded and pass through normal clearance holes with finger pressure. No special clearance holes are required.



**LONG-LOK Self-Locking Screws** save time and money because they eliminate safety wire (and head drilling), and lock washers. They also save weight.



**LONG-LOK Self-Locking Screws** are available for aircraft, missile and commercial applications. They meet MIL-F-18240 Specifications and can be head marked for self-lock identification.



Write for Catalog LL-61



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## IDEAS...MECHANICAL

### Launching, Arrestment-Landing System Uses Aircraft Components

E. J. Stefanides, Central States Editor

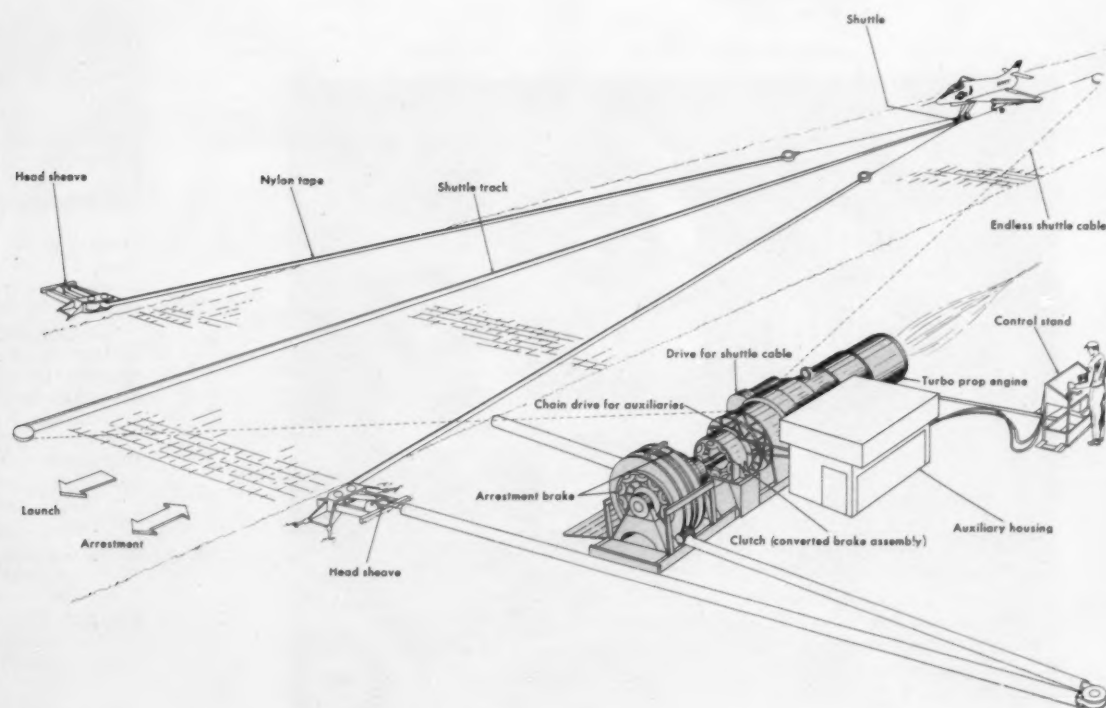
Dual-purpose equipment for the launching and arrested-landing of tactical jet aircraft is self-contained and air transportable. It is powered by a 6950-hp, Pratt and Whitney T-34-9W turboprop aircraft engine and makes extensive use of standard aircraft components in the power transmission and arrestment-braking assemblies. The aircraft parts, because of their inherent high capacities, light weight and compactness, contribute to the air transport capabilities of the equipment. They also simplify the maintenance and logistics of the equipment when installed at forward-area air strips.

#### Launch

The aircraft is attached by a bridle to two flat, plastic-impregnated nylon tapes which are reeved

to a twin drum reel. The reel, driven by the turboprop engine, takes up the tapes, accelerating the plane to a take-off speed of 150 knots.

One of the major problems involved in design of the system was providing a satisfactory device for coupling the engine to the reel during launch. Not only was the coupling device, or clutch, required to transmit the full torque of the engine, but also it was required to have an inherent capacity to slip under certain conditions to protect the equipment from damage. The latter consideration is important at the end of the launch, when the tape traveling under its own inertia at 150 knots actually reverses the reel and then is drawn up taut after its kinetic energy is dissipated. The capacity to slip is also an important factor in protecting the equipment

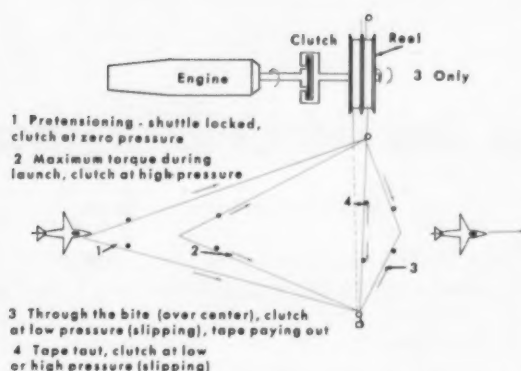


**LAUNCHING AND ARRESTMENT-LANDING SYSTEM ENGINE** is located on same side of runway as control stand. Tapes pay off both sides of reel and travel through pipes to head sheaves at edges of runway. Two-leg sheave layout on engine side equalizes reel-to-head sheave lengths of tape, preventing side thrust during arrestment. At aircraft end,

tapes are attached to track-mounted shuttle to which the aircraft is connected by bridle. During retrieval, endless cable chain driven off the engine carries shuttle back to battery (initial launch) position. During arrestment, tape is disconnected from shuttle.

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against damage should the operator not release the clutch at the completion of the launch.

To meet both coupling requirements in a small, light package, a B-52 brake unit is converted to serve as the clutch. The normally stationary portion of the brake is fastened to the reel shaft and equipped with a special lining whose sliding coefficient of friction is as close as possible to its static coefficient. The clutch is controlled by hydraulic system having two operating pressures. During launch, the higher pressure is used to transmit the full torque of the engine. Just before going through the bite (over center), the operator drops to a lower pressure (approximately 1/3 full pressure) to provide a lighter braking force during reversal and to protect against overstressing of the tape or equipment when the tape is fully taken up. The system is also capable of operating for short periods of time at full hydraulic pressure against a taut tape without damage in the event the clutch is not released.



**LAUNCH AND ARRESTMENT ENGINE** consists of 5-ft-dia twin-drum reel connected through converted B-52 brake assembly "clutch" to integral reduction gear of turboprop engine. Arrestment brakes also are converted B-52 components. They brake against tape reel hubs and operate from separate hydraulic control system.

SKETCH shows unusual characteristics required by clutch during launch operation. These were realized by converting aircraft disc brake to serve as clutch. During launch, full hydraulic clutch pressure transmits maximum torque to provide acceleration proportional to rpm and belt thickness. At completion of launch, reduced pressure and inherent slip capacity provides braking to dissipate tape kinetic energy and to allow slip when drawn up taut.

#### Arrestment

The aircraft's arresting hook engages the arresting towing pendant and pays the tape off the reel against the drag of another B-52 aircraft brake assembly which brakes against the reel hub. The engine is disengaged during the actual arrestment although it is used to take up the tape after arrestment is completed and to power the auxiliaries.

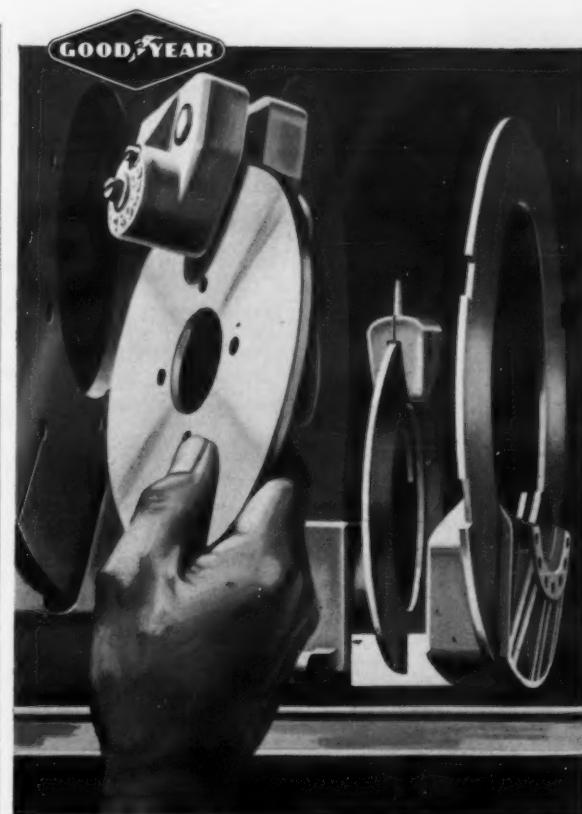
#### Capabilities

The actual capabilities of the device cannot be released at this time. However, the device is capable of launching any of the present Marine Corps jet fighters without JATO assistance.

The equipment, designated the "Catapult", was developed by the E. W. Bliss Co., Canton, Ohio, at its Philadelphia International Airport Div. for the Bureau of Naval Weapons.

The "Catapult" system is currently undergoing tests with deadloads. Subsequent testing with aircraft will complete the evaluation phase.

➤ **DEAD WEIGHT TEST DEVICE** traveling down runway at approximately 127 knots during launch. Device approximates weight of 20,000-lb fighter craft.



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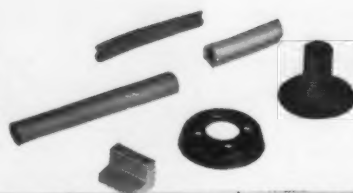
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\*f.o.b. Akron; subject to quantity discount.

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## RUBBER in Design Engineering



PROPERTIES	Non-Oil Resistant			Oil Resistant	
	Natural	SBR	Butyl	Nitrile	Neoprene
Tear Resistance	Excellent	Poor-fair	Good	Fair	Good
Abrasion Resistance	Excellent	Good	Good	Excellent	Excellent
Compression Set Resistance	Good	Good	Good	Very good	Good
Permeability to Gases	Fair	Fair	Excellent	Very good	Very good
Aging (Sunlight)	Poor	Poor	Excellent	Fair	Excellent
Aging (Oxidation)	Good	Good	Good	Fair	Good
Aging (Heat, max. temp. F)	200	250	300	250	250
Solvent Resistance					
(Aliphatic Hydrocarbons)	Very poor	Very poor	Poor	Good-Exc.	Fair
(Aromatic Hydrocarbons)	Very poor	Very poor	Poor	Fair-good	Poor
Oil Resistance					
(Low Aniline)	Very poor	Very poor	Very poor	Fair-Exc.	Fair
Oil Resistance					
(High Aniline)	Very poor	Very poor	Very poor	Fair-Exc.	Good
Gasoline Resistance					
(Aromatic)	Very poor	Very poor	Very poor	Fair-good	Fair
Gasoline Resistance					
(Non-aromatic)	Very poor	Very poor	Very poor	Good-Exc.	Good
Cold Resistance					
(Min. svc temp. F)	-65	-70	-65	-65	-50

This table gives you an idea of how some rubbers react to various conditions. In designing, consult your Garlock rubber specialist to achieve best application results.



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Garlock offers dozens of different types of rubber, each carefully chosen and processed to meet your exacting needs . . . natural rubber with high tensile strength where real "rubber-like" properties are required . . . styrene butadiene rubber, the work horse of the industry—a low cost material for use where a good, rugged general purpose compound is required . . . neoprene rubber where good oil and abrasion resistance and aging characteristics are important. In addition, Garlock offers a wide range of nitrile and butyl compounds where their special properties are required. For more difficult applications Garlock offers a complete line of specialty rubbers from silicone for high and low temperature service to VITON\* for extreme temperature and solvent resistance.

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**No two rubbers are alike.** Each has its own individual strong points; each performs better under one set of conditions than another. In the design stage, call in your Garlock representative. He's a specialist in rubber parts and will assist you in selecting the proper material. Then, too, he may have several cost-saving ideas to suggest. You

can reach him at the nearest of the 26 Garlock sales offices and warehouses throughout the U. S. and Canada. Or, write for Catalog AD-167, Garlock Inc., Palmyra, N. Y.

**Canadian Div.:** Garlock of Canada Ltd.  
**Plastics Div.:** United States Gasket Co.

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\*Du Pont Trademark

## IDEAS . . . MECHANICAL

### Jack Linkage Arrangement

Lars G. Soderholm, Midwest Editor

A new four-ton automotive service jack gets a 50 percent higher lift with a shorter length (and no additional weight) through a patented linkage arrangement. The basic parallelogram lifting linkage is used with the hydraulic ram located under the lift arms so it can act against the long lift links. A spring-loaded needle valve regulates rate of jack descent and acts as a relief valve against overloads on the hydraulic system.

The hydraulic lift cylinder applies force directly to the long link at a point near the saddle. This reduces the stresses in the lift members and permits lighter sections to be used.

The manually operated lift pump fits inside the oil reservoir and uses two separate pump cylinders. Both provide initial lift, but as resistance is met, the larger pump cylinder bypasses its oil to the reservoir at about 150-lb saddle load. The smaller high-pressure pump cylinder continues to build up pressure in the hydraulic ram.

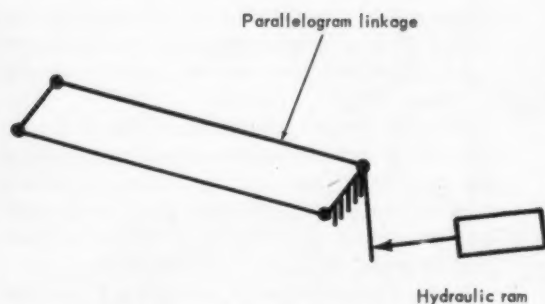
Oil passes from the pump to the ram through drilled passages inside the pivot shaft connecting the two components. O-ring seals are used to isolate the pivot shaft inlet and outlet openings. A spring-loaded needle valve is used to seal the oil return orifice.

When the jack is to be lowered, a threaded plunger is turned which causes a pivot plate to

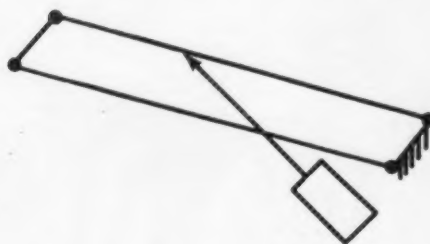


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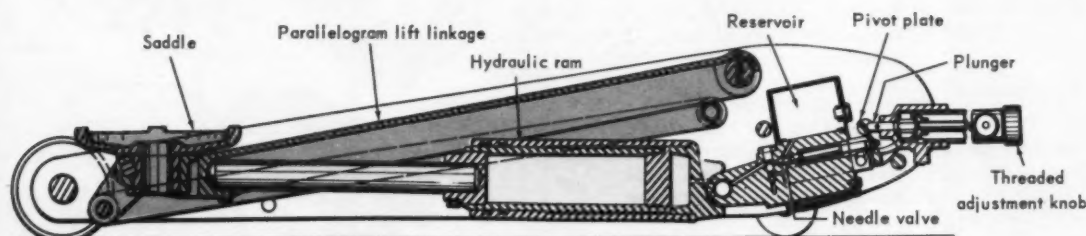
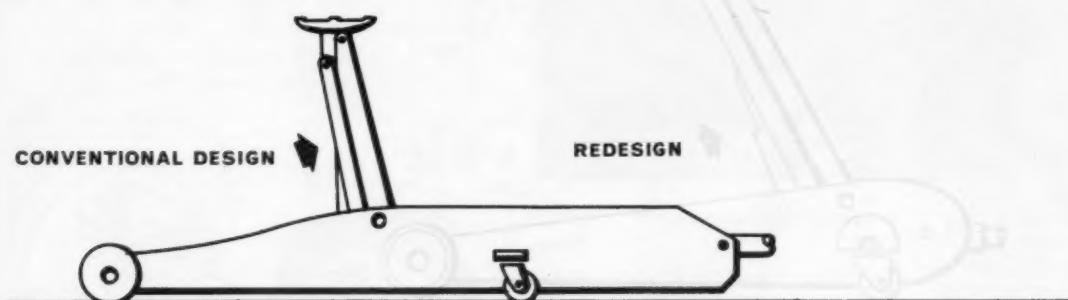
## Provides High Lift, Shorter Length



### CONVENTIONAL JACK ASSEMBLY



### HIGH LIFT JACK ASSEMBLY



lift the needle off its seat. This controls rate of descent. The spring holding the needle valve lifts off the orifice at 8800-lb saddle load to act as a safety valve in case the jack becomes overloaded.

The hydraulic section of the jack can be dropped completely for replacement or servicing by removing three screws. Two of the screws fit on either

side of the reservoir-pump unit, the other fastens the cylinder piston to the lift linkage.

Model 436, four-ton service jack has a 36-inch maximum and 5-inch minimum saddle height and weighs 231 lb. It is made by the Milwaukee Hydraulic Products Corp., Milwaukee, Wis.

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**Dillon** ACCURACY  
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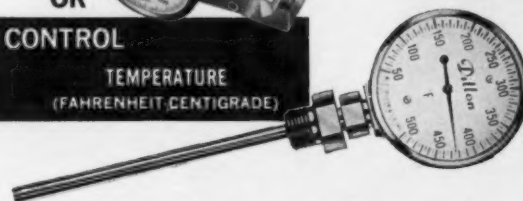
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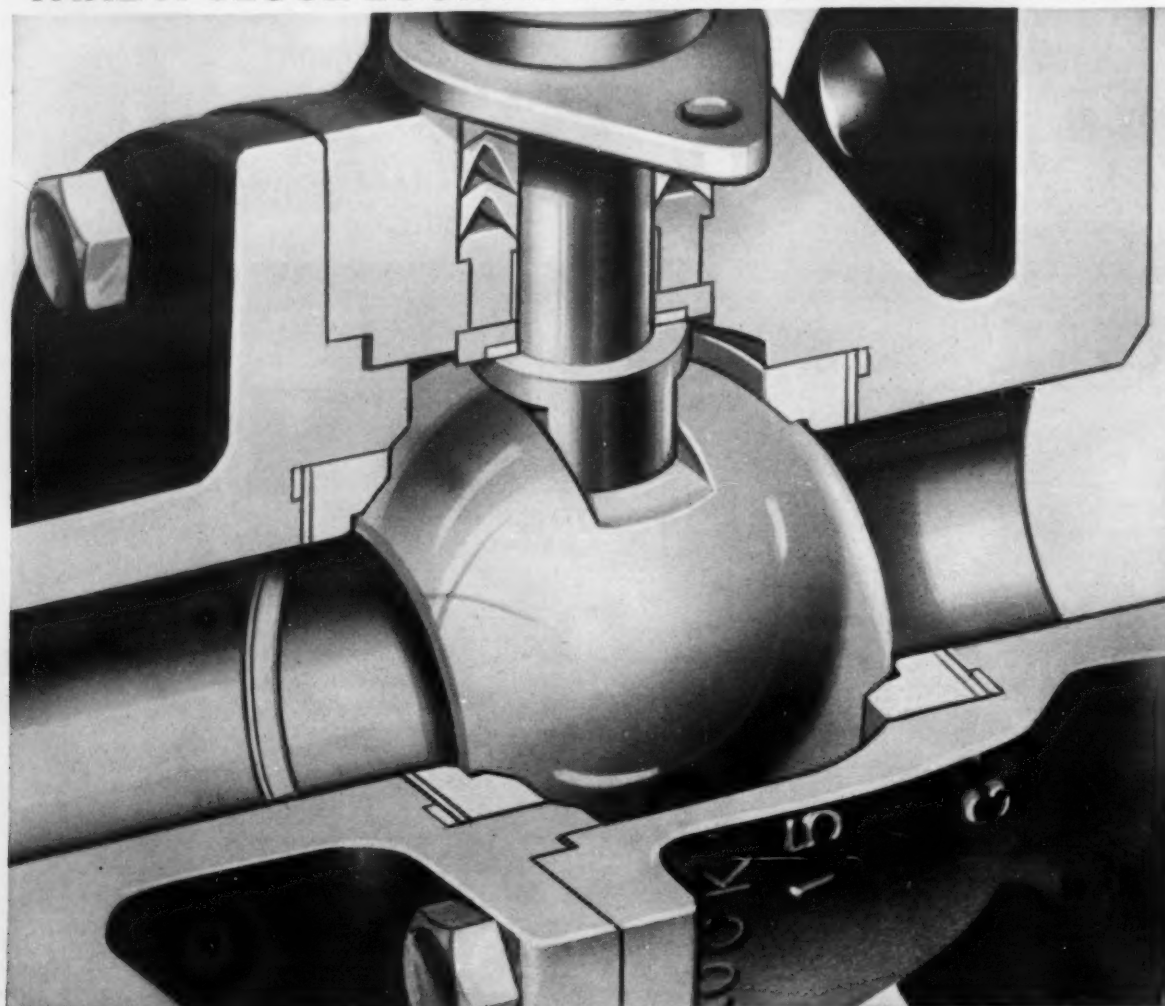
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## TAKE A CLOSE LOOK AT ROCKWOOD BALL VALVES



### Where does experience come in?

Here are some factors to consider. Rockwood was the first to manufacture a commercial ball valve — with a design that has been time-proven in thousands of installations over the past 18 years. Rockwood is constantly making new refinements based on their solid "on-the-line" experience. Refinements such as truly spring-loaded ball

seats . . . rubber seats that seal tight and stay tight through all conditions . . . Teflon stem packing to reduce wear — all intended to make quality better, service life longer.

And when you specify Rockwood Ball Valves, you get a wider choice of ball valve types and sizes.

Rockwood Ball Valves have these other important advantages too:

**Ease of maintenance** — no lubrication required; parts replaceable with ordinary tools.

**Larger waterway diameters** for smoother flow.

**Durability** — built to withstand rough handling during installation . . . long, hard usage afterward.

Get the complete details from your Rockwood man, or write Rockwood Sprinkler Company, Ball Valve Department, 857 Harlow Street, Worcester 5, Mass. Distributors in all principal industrial areas. Rockwood Sprinkler Company, A Division of The Gamewell Company, A Subsidiary of E.W. Bliss Company.

# ROCKWOOD

## BALL VALVES

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## IDEAS . . . MECHANICAL

### Adjustable Shutter

Ronald W. E. Martin, British Editor

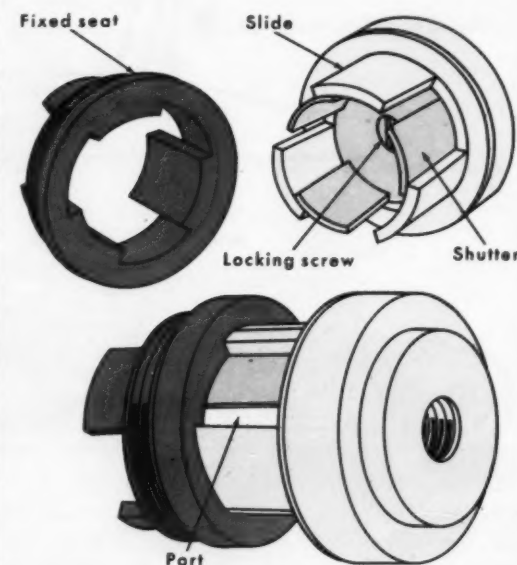
Ports between an axially moving cylindrical slide and its seat are modified by an additional coaxial shutter to control maximum flow through a new valve. Maximum flow can be preset to specific process-control requirements.

Three concentric projections on the slide have the same dimensions as corresponding grooves in the seat. Slide and seat interleave to form a solid cylinder when the two parts are pushed together. Fluid flows through the three ports opened when the slide is lifted from the seat.

The rectangular ports are blocked partially by the three-pronged shutter fitting inside the slide. Rotation of the shutter increases or decreases the maximum flow rate.

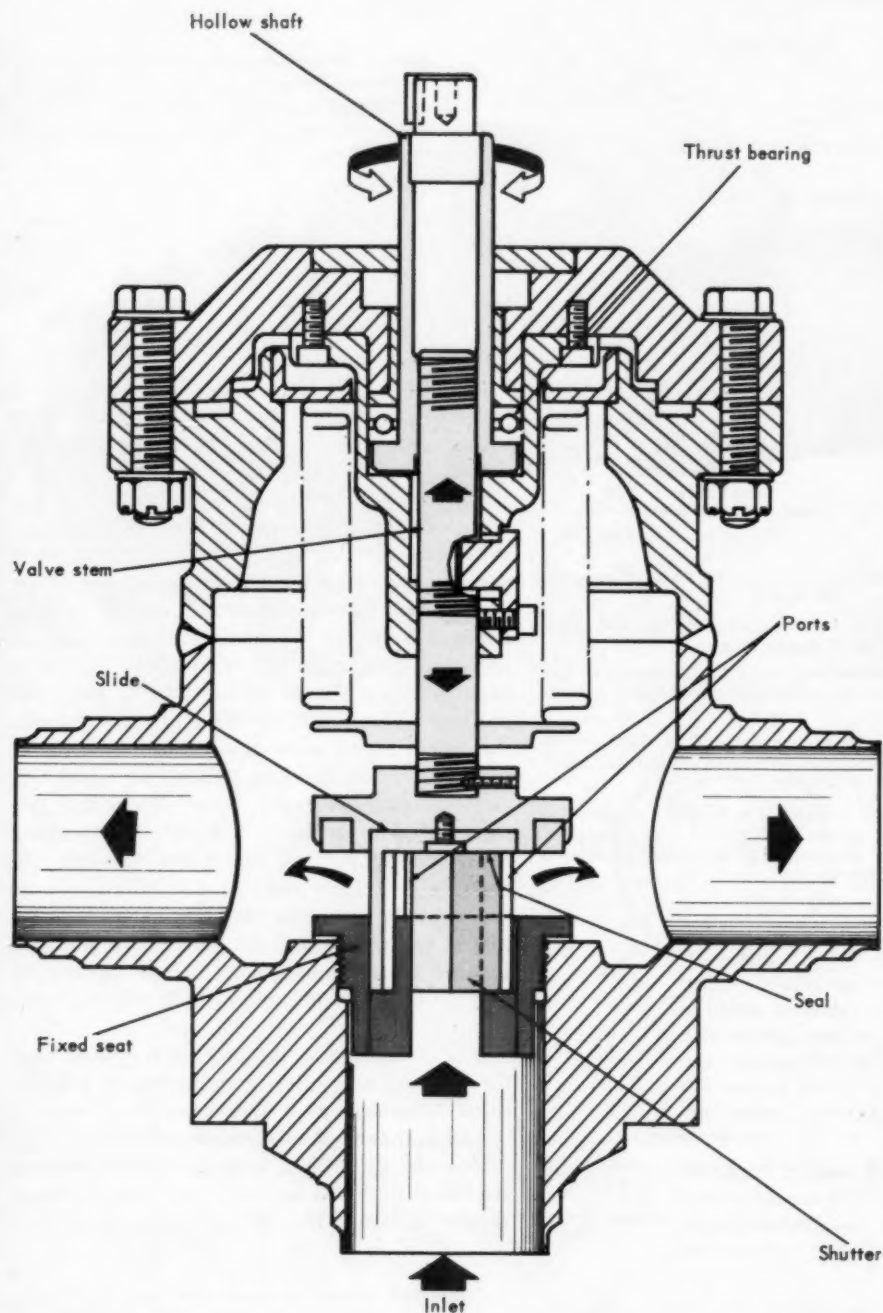
In operation, the shutter is set for a predetermined flow rate and locked inside the slide. The valve is opened or closed by rotating the hollow shaft, which is internally threaded to displace the valve stem axially. The valve slide moves with the stem. Complete closure is obtained by a sealing ring clamped between seat and slide in the extreme closed position.

The valve (patent applied for) was designed by the United Kingdom Atomic Energy Authority.



MAXIMUM FLOW through valve is varied by presetting movable shutter. Rotation of shutter changes ports in slide.

## Controls Maximum Flow through Valve



VALVE has operating shaft and stem housed in body coaxially with shutter, slide and seat. Flexible metal bellows prevents leakage past stem. Shutter is locked to slide with set screw.

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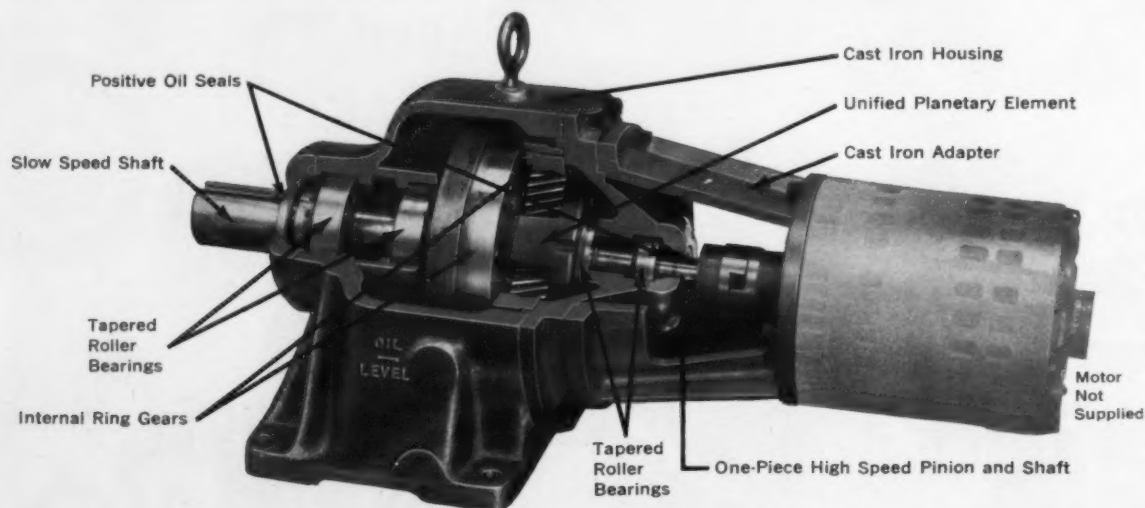
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## Engineering Data

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**CAST IRON ADAPTER**—permits use of any standard "C" flange motor. Flexible coupling (optional) connects motor to input shaft which can be driven in either direction.

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**TAPERED ROLLER BEARINGS**—opposed pairs support the radial load, take thrust, ensure permanent alignment of both input and output shafts.

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• • • Winsmith Speed Reducers are made by American craftsmen to meet American design and production standards.

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## IDEAS...MECHANICAL

### Moving Tabs

Edward W. Schrader, Western Editor

**GOX LINE** extends from rear-mounted heat exchanger manifold to top of center LOX tank and is used to pressurize LOX tanks. Operating pressure is 300 psig over a temperature range of -300F to +500F.

The gaseous oxygen line in the Saturn booster moves axially  $\pm 1\frac{1}{2}$  inches. Three stainless-steel bellows absorb this contraction and expansion of the four-inch diameter line in a sliding joint.

To avoid side deflection or bending of the bellows, tubes encircle the bellows and sliding feet joined to the bellows at the seam welds guide the movement in an axial direction. All rubbing surfaces are dry-film lubricated.

The outer tube contains three sets of three tabs, each equally spaced around its periphery. When the bellows move, for example in compression, the rear tab impinges against one of the sliding feet insuring that the middle bellows moves  $\frac{1}{3}$  of the distance. The center tab is spaced so that after  $\frac{2}{3}$  of the total travel, it impinges on a second sliding foot to move the last bellows its  $\frac{1}{3}$  of the travel. In this manner, the initial axial movement in compression of the tube causes the first bellows to move  $\frac{1}{3}$ , and two successive tabs cause additional movement to occur in the second and third bellows, thus distributing the movement between the three bellows. In expansion, or compression from the opposite direction, the reverse action takes place, again utilizing the center tab and the forward tab to compress the bellows equally, or to expand the bellows, from their nominal position.

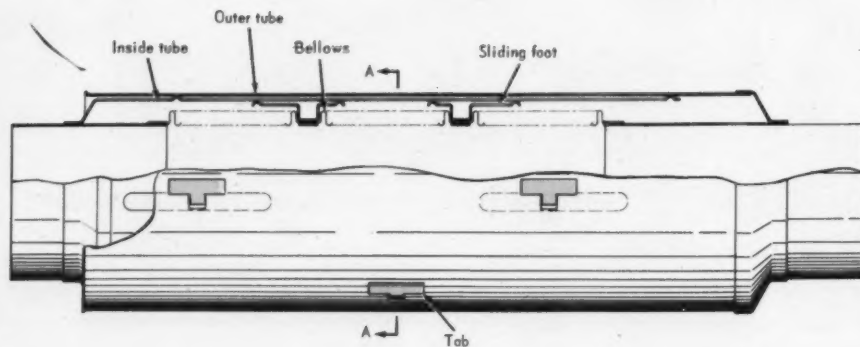
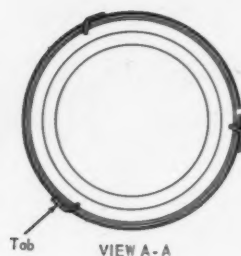
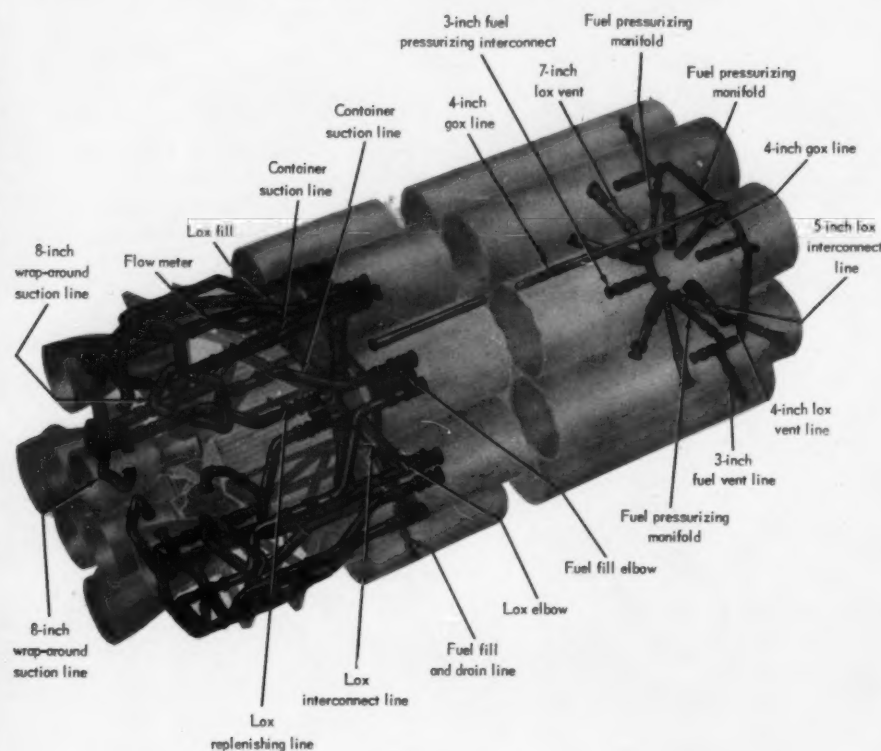
The design leaves the bore of the joint clear for cleaning and offers a minimum of pressure drop. Axial deflection is maintained at less than  $\pm 1.50$  inches in a 23-inch length.

The sliding joint is a design development of Arrowhead Products, Div. of Federal-Mogul-Bower Bearings, Inc., Long Beach, Calif.

**SLIDING JOINT** is made from type 321 stainless steel for gaseous oxygen service. Axial movement of each bellows is limited to  $\frac{1}{2}$  inch in either direction of normal position. Tabs mounted on periphery of encasing tube push sliding feet to equalize movement among three bellows.



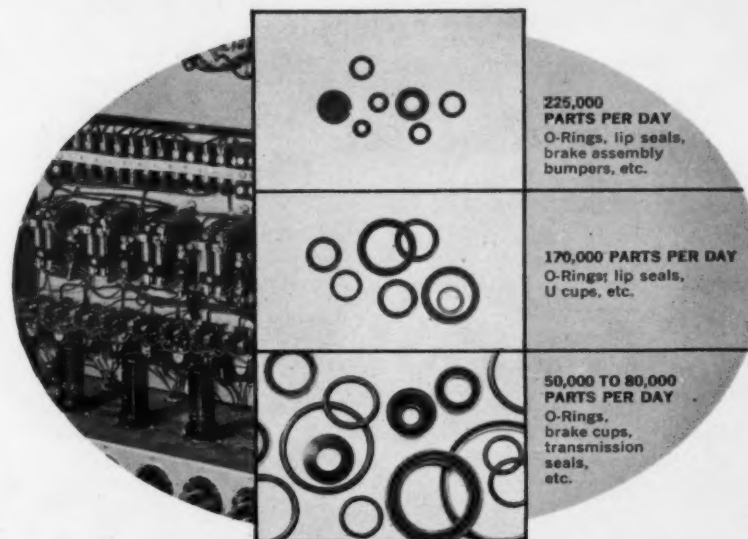
## Equalize Bellows Travel in Sliding Joint



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Bearing at left has 1.75" bore, while tandem bearing in main illustration has 17.0" bore. Yet both are standard, cataloged items.

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## IDEAS...MECHANICAL

### Compression of Calibrated

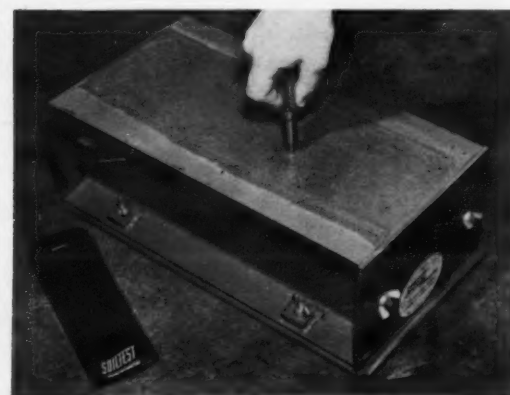
Lars G. Soderholm, Midwest Editor

The compression of a calibrated spring in a pocket concrete penetrometer is used to evaluate the initial set of concrete. Compression of the spring measures the resistance to penetration of a 1/20-sq-in shaft. Deflection of the spring pushes a sliding indicator on a 0- to 700-psi scale.

Initial set of concrete is that time after which it cannot be vibrated or worked in any way. In construction work, this time varies with conditions of temperature and humidity. Also, in recent years, additives have been developed that will retard or accelerate the setting time.

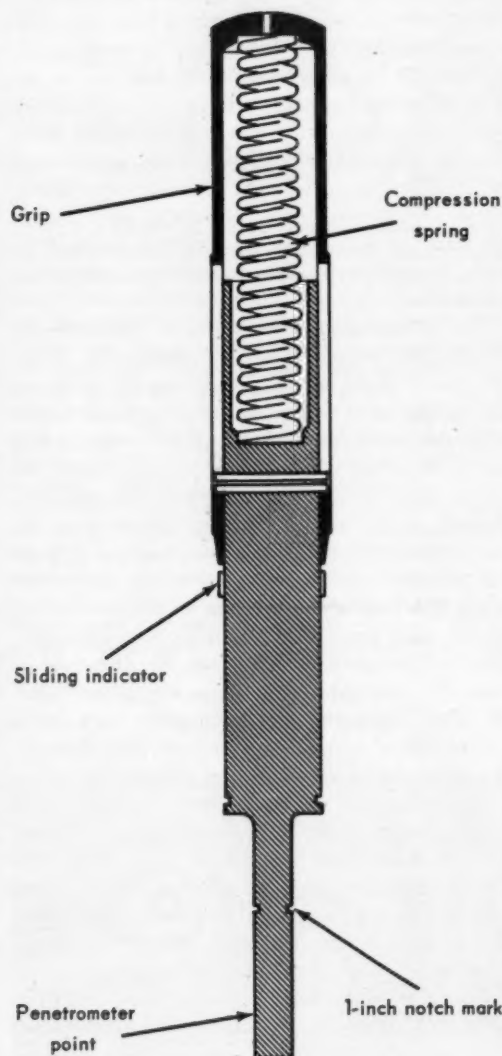
The pocket concrete penetrometer was designed to provide an instrument capable of making field checks of concrete materials. The operator need only push the penetrometer point 1 inch into the concrete mix and then pull it out again. The sliding indicator holds a reading until it is manually returned to its zero mark. Up to a reading of 500 psi, concrete can be worked although the closer the reading is to 500 psi, the more difficult it becomes. These tests can be performed satisfactorily by relatively unskilled help where necessary.

The CT-421 concrete penetrometer is made by Soiltest, Inc., Chicago, Ill.



PENETROMETER OPERATION requires shaft be pushed into concrete up to inscribed 1-inch mark. Resistance to penetration squeezes compression spring, causing penetrating shaft and scale to slide inside of cylindrical holder. Sliding indicator collar remains at position of maximum resistance after penetrometer is withdrawn from mix. Scale range of 0 to 700 psi indicates when initial set conditions have been reached.

## Spring Measures Concrete 'Set'



# Whatever you make... there's a WALDES TRUARC® RETAINING RING designed to improve your product...lower assembly costs

function	for axial assembly					for taking up end-play					
	basic		heavy duty	inverted		axial assembly		radial assembly			
nomenclature						bowed	beveled	bowed e-ring	prong-lock		
series no.	5000 N5000	5100	5160	5008	5108	N5001	5101	5002 N5002	5102	5131	5139
application	Internal for Housings, Bores	External for Shafts	External for Shafts	Internal for Housings, Bores	External for Shafts	Internal for Housings, Bores	External for Shafts	Internal for Housings, Bores	External for Shafts	External for Shafts	External for Shafts
size range	in.	.250 - 10.0	.125 - 10.0	.394 - 2.0	.750 - 4.0	.500 - 4.0	.250 - 1.500	.188 - 1.500	1.0 - 10.0	1.0 - 10.0	.110 - 1.375
	mm.	6.4 - 254.0	3.2 - 254.0	10.0 - 50.8	19.0 - 101.6	12.7 - 101.6	6.4 - 38.1	4.8 - 38.1	25.4 - 254.0	25.4 - 254.0	2.8 - 34.9

function	for radial assembly				self-locking types					
	crescent	e-ring	interlocking	reinforced e-ring	circular self-locking		grip-ring	triangular self-locking	triangular nut	
series no.	5103	5133	5107	5144	5115	5105	5005	5555	5305	5300
application	External for Shafts	External for Shafts	External for Shafts	External for Shafts	External for Shafts	External for Shafts	Internal for Housings, Bores	External for Shafts	External for Shafts	With Threaded Screw
size range	in.	.125 - 2.0	.040 - 1.375	.469 - 3.375	.094 - .562	.094 - 1.0	.312 - 2.0	.079 - .750	.062 - .438	
	mm.	3.2 - 50.8	1.0 - 34.9	11.9 - 85.7	2.4 - 14.3			2.0 - 19.0		

Truarc retaining rings are precision-engineered fasteners which simplify design, speed production and reduce material, machining and assembly costs. They may be used to retain components on shafts and in bores and housings .040" to 10" dia. - and rings as large as 40" dia. have been developed for special applications! Truarc rings are installed in easy-to-cut grooves and self-locking types are available which do not require any preparatory machining. Altogether, there are 50 functionally different types... some with as many as 98 sizes... in 6 metals and 13 finishes.

**More than a fastener!** Truarc rings function as mechanical components by replacing machined shoulders, set collars, rivets, threaded fasteners and other bulkier and more expensive fastening devices. They

eliminate drilling, tapping, threading and other costly machining operations. Speed of assembly and disassembly further reduces manufacturing costs and simplifies field service.

**Assembly tools for every requirement:** Truarc offers you the most complete line of pliers, applicators, dispensers and portable magazine-fed tools for high-speed ring installation... even fully mechanized and automated equipment for mass-production assembly operations.

**Engineering Service:** We'll be happy to help you solve your fastening problems. Send us your blueprints or contact your local Truarc representative or distributor. They're listed in the Classified Telephone Directory under "Retaining Rings" or "Rings, Retaining."

**WALDES KOHINOOR, INC.**

47-16 Austal Place • Long Island City 1, N.Y.

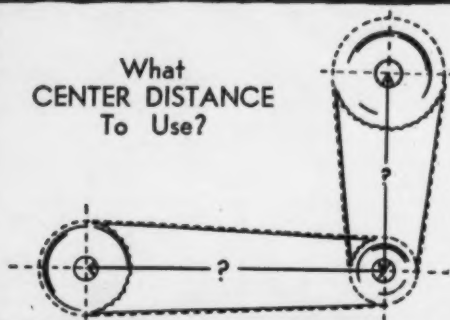


Circle 25 on Reader-Service Card for more information

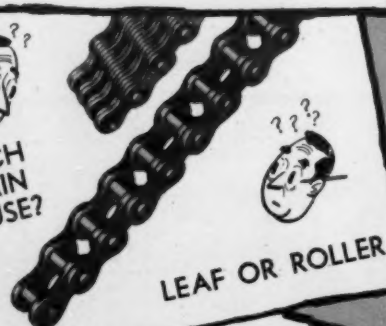


# POWER TRANSMISSION PROBLEMS VANISH...

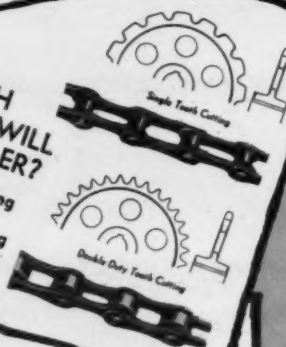
What  
CENTER DISTANCE  
To Use?



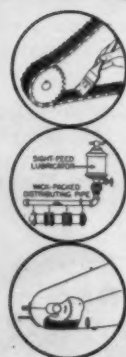
WHICH  
CHAIN  
TO USE?



WHICH  
SPROCKET WILL  
LAST LONGER?  
Single Tooth Cutting  
or  
Double Tooth Cutting



WHAT TYPE  
OF CHAIN  
LUBRICATION?  
MANUAL, DRIP  
OR IMMERSION?



and many more prob-  
lems confronting the en-  
gineer.

## with ACME'S SPECIALIZED ENGINEERING SERVICE!

When manufacturers run into situations involving design, installation or any other roller chain problem, they can rely on ACME's Engineering Service for help. The years of experience in the power transmission field and the skilled technical knowledge of our Engineers are always at your command.

Selection of the correct size chain, for instance, is of vital importance to efficient operations — a wrong choice could result in costly production setbacks. Consultation with ACME's Engineering Department assures sound technical advice and avoids unnecessary complications. Consideration of such factors as horsepower to be transmitted, size and speed of shaft, space limitations, etc., will determine the standard size of chain required to best do the job. This size, or any other size, can be obtained off-the-shelf from your Industrial Distributor.

ACME Engineers are ready at all times to help you solve any problems involving roller chains at no cost to you. Consult your ACME Distributor, call or write our Engineering Department for assistance.

RELIABLE CHAIN DRIVES FOR ALL INDUSTRIES

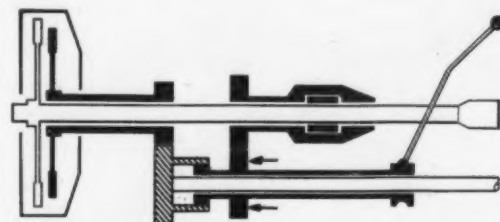


Write Dept. 14-C for  
new 106 page illustrated catalog  
with engineering section.

## IDEAS... MECHANICAL

### Coaxial Disc Clutches

George B. Bernard, Correspondent in France



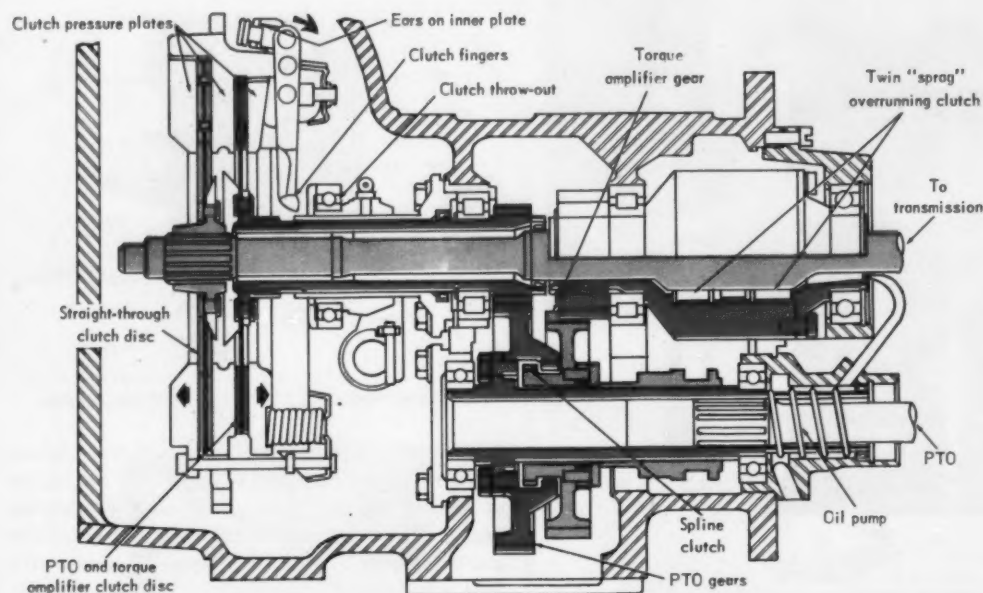
A clutch mechanism with two friction discs and two coaxial outputs disengages discs sequentially as the pedal is depressed, permitting uninterrupted power flow while changing from one gear ratio to another. Increased torque at lower speed is obtained by using the power take-off as lay shaft. A sprag-type overrunning clutch prevents interference between the two drives when both discs are engaged. The design finds application on agricultural tractors intended for deep plowing or very heavy towing. Normally, such a tractor stops at once when an attempt is made to shift through neutral and is unable to start again under load.

The torque amplifier is placed between the engine and a standard tractor transmission. With the clutch pedal released, the straight shaft to the transmission input rotates 50 percent faster than the secondary drive, whose overrunning clutch slips and transmits no power. When the clutch pedal is depressed halfway, the straight-through power train is broken. Transmission input shaft speed drops, but on reaching 2/3 of the previous speed, the overrunning clutch engages and continues drive at 50 percent higher torque than previously attained. The secondary drive is through a tube around the direct shaft, from the tube through gears to the power take-off shaft, through two other gears back to a sleeve coaxial with the direct shaft and through the overrunning clutch to the direct shaft.

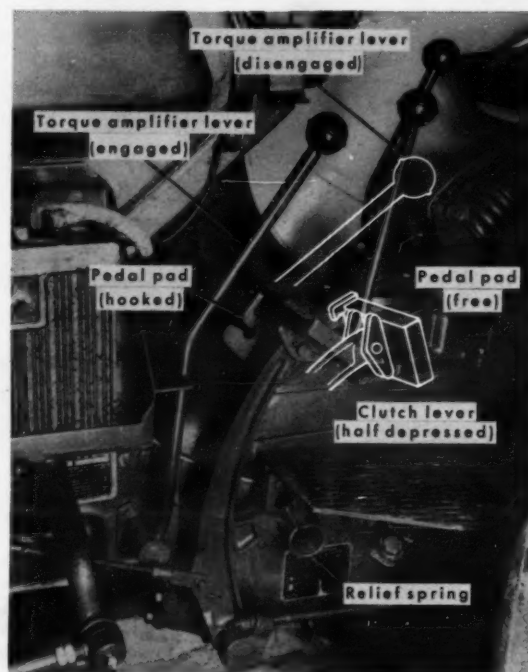
The secondary power train is broken by a spline clutch between the gears on the power take-off shaft, permitting disengagement of the torque amplifier for drive and use of the power take-off as such. Full depression of the main clutch pedal breaks all connections to the engine. The drive is part of the SOM-55 tractor designed and developed by SOMECA Division of SIMCA Industries, Puteaux, France, and is said to have survived extensive testing without showing wear.

Circle 26 on Reader-Service Card for more information

## Maintain Tractor Power While Shifting



**CENTRAL CLUTCH PLATE** is driven directly by engine through peripheral connection (not shown). Clutch fingers are hinged on central clutch plate. Pedal depression moves clutch throw-out toward fingers which pivot around central hinge and cause outer clutch plate to separate from friction disc. This action is completed when pedal is halfway down, breaking direct power flow to transmission. Further throw-out movement brings adjustment nuts on fingers against gears on inner clutch plate, causing this plate to separate from power take-off (torque amplifier) friction disc. Springs provide clutch pressure when pedal is released. With both clutches fully engaged, overrunning clutch housing turns at about 2/3 speed of direct drive, and sprags slip. Disengagement of direct drive clutch causes shaft to slow down, and when it reaches 2/3 former speed, sprags take hold and transmit to it a torque 50 per cent higher than that previously available. Spline clutch between gears on power take-off shaft cuts power flow to torque amplifier gears when PTO shaft is to be used alone.



**CLUTCH PEDAL OPERATION** is aided by pivoting pedal pad on clutch lever. Hook on pad engages an arresting catch in halfway position and permits extended use of torque amplifier without tiring driver. In addition, a snap-action spring opposes pedal depression during first half of travel, then aids it.

## NEW INDEX TABLE

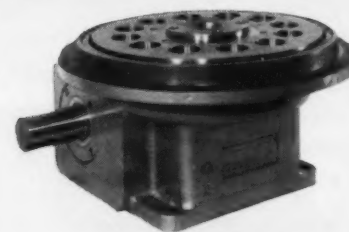
by **CMC**



The one unit that does bigger jobs better . . . Series "A" High Speed Index Table is quality to the highest standards . . . provides extreme accuracy of .001 on a 28" diameter . . . efficiently handles loads of 24,000 inch pounds, and over, with outstanding accuracy and maintains zero backlash in dwell position with a high-speed jerk-free operation . . . enables designers to make full use of modern high speed equipment.

With the New Series "A" Index Table You Get:

- Timken bearing near outside diameter of cam follower plate for greatly increased stability
- Supports dial plate load of 18,000 lbs.
- Machined housing surface for mounting tooling plate and permitting shaft mounted speed reducers to be fitted direct
- Immediate adaptability to dial plate of your choice
- Hollow output shaft enables air, fluids, coolants or additional tooling to be brought directly to center of work area
- Hardened, MACHINE GROUND tool steel cam; precision bearings; MACHINE GROUND critical components



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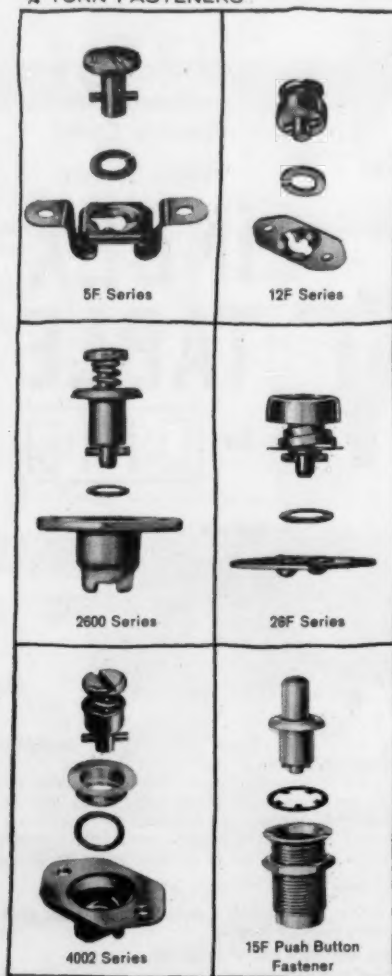
Established 1931



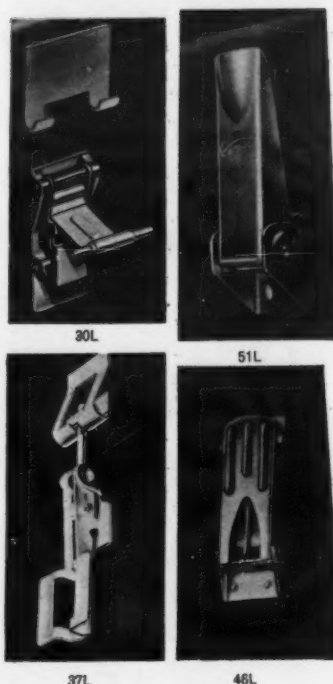
Circle 27 on Reader-Service Card for more information



#### 1/4 TURN FASTENERS



#### UNIVERSAL LATCHES



#### CHASSIS LATCHES



21L Latch



35L Latch

#### HARNESS CLAMPS

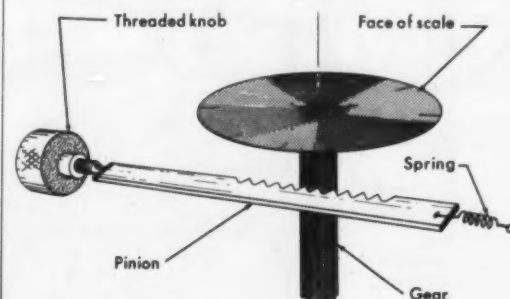


7C1 Clamp

#### IDEAS...MECHANICAL

### Stamped Levers Replace Riveted,

Lars G. Soderholm, Midwest Editor



RACK AND PINION SCALE ADJUSTMENT MECHANISM

A new personal scale uses simple, stamped levers in its weighing mechanism to replace assemblies of welded, formed parts used in the previous model. This has resulted in a simpler but more stable scale that retains the same accuracy with only a fraction of the weight of the older model.

The basic scale mechanism consisting of spring and levers was well refined so the major design effort was expended in cutting costs in terms of material and assembly time without reducing the accuracy or utility of the scale.

The previous model used levers made of formed shapes riveted together in assemblies. These assemblies were pivoted on fulcrum supports that were welded to the scale base while located in a fixture.

The new scale uses simple levers blanked out by "cookie-cutter"-type dies. The die maintains the required dimensional accuracy and insures that all the levers are the same. Instead of welded supports, the levers are supported in notched portions of the base flange. This has resulted in a greater spread of support positions for greater stability.

The previous scale adjustment knob operated in the conventional manner by changing the load on the spring. The new scale uses a rack and pinion arrangement which permits the face of the scale to be reset without tampering with the spring.

The difference in construction between the previous and new scale models have resulted in a scale weighing 3-1/2 lb compared to the 5-1/2 lb of the old one.

The "77M" personal scale is manufactured by the Hanson Scale Co., Northbrook, Ill.

## FASTEN/ATION

The mechanics of modern fastening have matured to the point where it is now considered a science. We call it FASTEN/ATION.

Your designs are important enough to build, and should be covered and protected... but you must be able to remove the covering in a hurry. Here's where Camloc's FASTEN/ATION becomes significant to you. Installation is simple — closure is simple — opening is even simpler, and each of these operations takes only seconds.

The final touch to a good design includes the best method of fastening, the simplest installation and use, and a fastener that complements the product in size and appearance. Since making a decision involves the evaluation of alternatives, here are some of Camloc's more popular fasteners. We know you will want to make a more careful analysis before you specify, we suggest that you write for our complete catalog. Be FASTEN/ATED! Let us FASTEN/EER your next design.

specialists in fasteners for industry



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European Subsidiary: Camloc Fastener GmbH, Kelkheim/Taunus, West Germany

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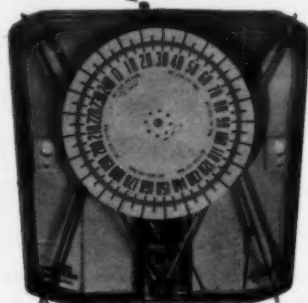


## Formed Assemblies in Scale



REDESIGN

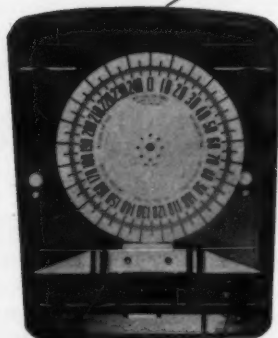
Scale adjustment



Levers suspended  
in notched base section

Stamped levers

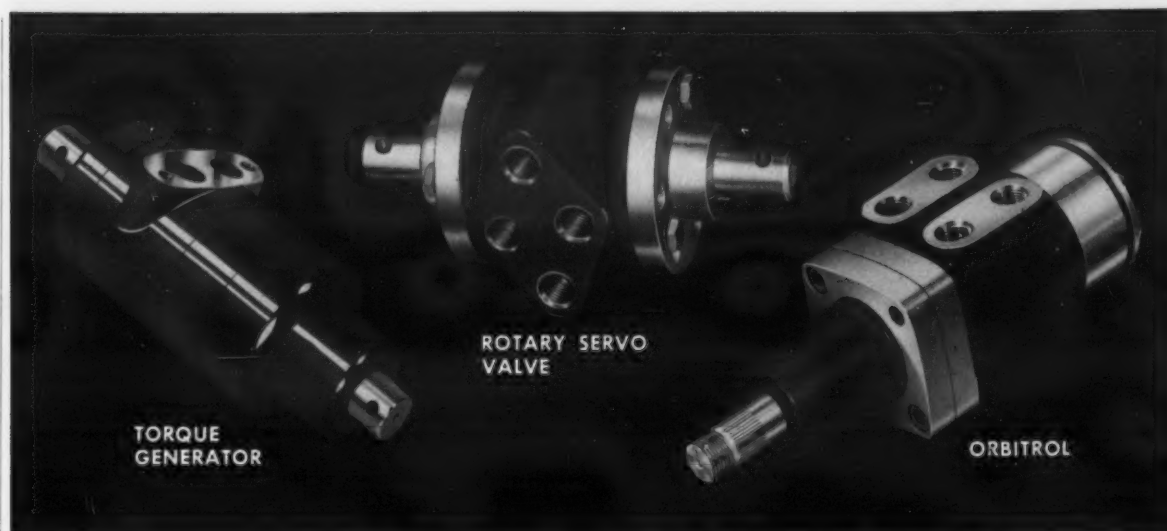
Scale adjustment



Riveted,  
formed assemblies

Separate fulcrum supports

PREVIOUS DESIGN



# Char-Lynn POWER STEERING

**Now available for *all* Types of Vehicles**

**3 Basic Controls • 30 Standard Models**

**TORQUE GENERATOR** is used to furnish **POWERED OPERATION** or **TORQUE AMPLIFICATION** to mechanical steering systems.

This remarkable steering control contains both a Servo Valve and Orbit Motor which delivers up to 1,100 in. lbs. of torque output at 1,000 PSI system pressure. Manual effort at the steering wheel is approximately 30 in. lbs.

Direct thru linkage within the unit provides means for manual steering of the vehicle during "engine off" or emergency conditions.

**ROTARY SERVO VALVE** is a remote control for steering systems where it is desirable to actuate the linkage by a hydraulic cylinder. Pressure feed-back provides "load feel" at the input shaft proportional to operating pressure. Also contains direct thru linkage for manual steering.

Although designed primarily for power steering systems, this versatile valve has unlimited use in other applications requiring remote servo control.

The all new **ORBITROL** is a completely integrated fluid steering control that eliminates any mechanical linkage to the axle. The **ORBITROL** provides remote rotary servo control with sensory direction and delivery measurement within the same unit.

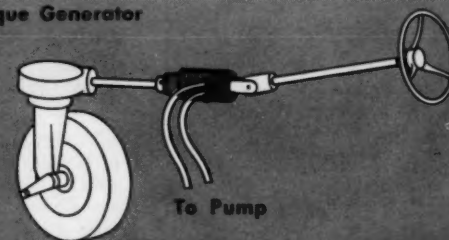
The hydraulic motor section of the Orbitrol functions as a metering device during normal power steering operation and reverts automatically to a rotary hand-pump for emergency manual control.

For complete information write:

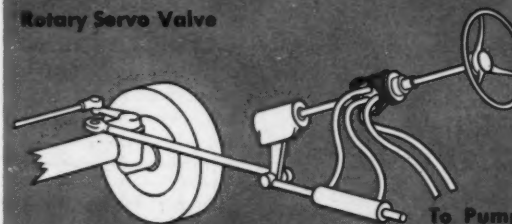


Char-Lynn Co., Dept. P-3  
2843 26th Avenue South  
Minneapolis 6, Minnesota

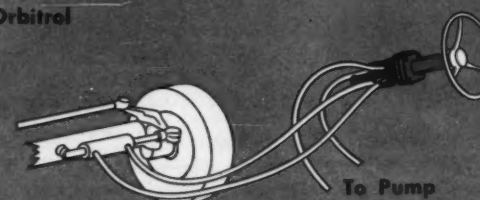
Torque Generator



Rotary Servo Valve



Orbitrol



## PRODUCT-DESIGN BRIEFS FROM DUREZ

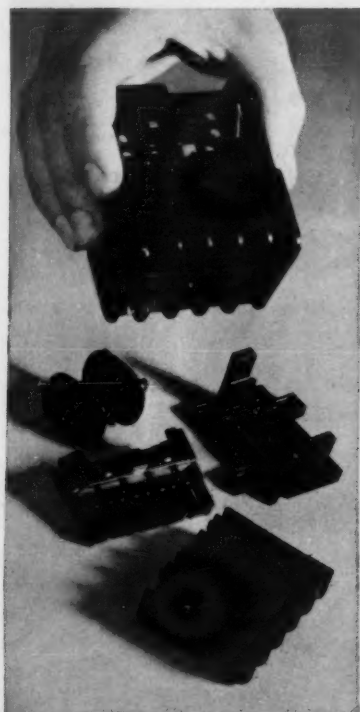
- Choosing materials for a relay
- Building bigger plastic tanks
- Designing rust out of a pump

### Space saver

"Build a relay that's small enough to put in a topcoat pocket—and has the power rating of much bigger relays."

This was the challenge Westinghouse engineers faced. They met it with the help of low-cost Durez® phenolic molding compounds.

Five structural members of the new relay are molded from phenolic. All are excellent examples of the fine detail that's achievable with today's phenolics to help you save space.



The relay's crossbar (left center), a moving part, requires extra strength in the contact supports. It is transfer molded from a Durez general-purpose compound that provides slightly higher-than-usual impact strength. Edges must be perfect, and very little flash can be tolerated.

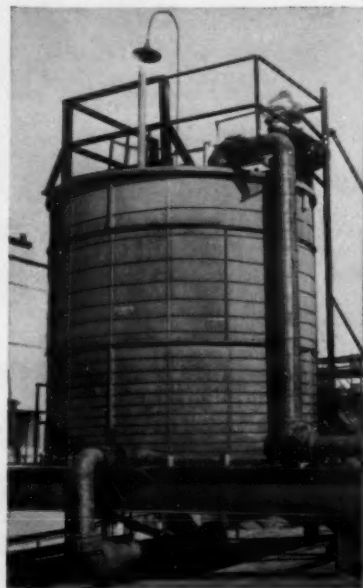
All other parts are molded in Durez 265 Black, a general-purpose compound chosen mainly for its good moldability.

### New twist in tanks

This concept in tank design mates the structural strength of steel with the corrosion resistance and fire retardance of Hetron® polyester-glass laminates.

The result is a very strong, durable tank that can be erected in virtually any size, with a safety factor of 40:1 or better. Besides being corrosion-resistant, the tank

is free from galvanic action. Some tanks can be molded translucent, which eliminates the need for gauging. Marketed under the name "Kabe-O-Rap," the tanks are produced by Metal-Cladding, Inc., North Tonawanda, N.Y.



Factory-molded tank segments are made of Hetron resin reinforced with fibrous glass. A stainless-steel cable is wrapped helically around the plastic shell. The cable stabilizes the shell by taking up nearly all stresses transmitted by contained liquids.

This is one of many structural jobs for which designers are choosing Hetron, the inherently self-extinguishing polyester. You can find out all about Hetron and its uses by checking the coupon for a copy of the "Designer's Data File."

### Super-tough plastic

This is part of a sump pump. It's the part you normally don't see—because it sits for months at a time in water that's dirty, oily, greasy, soapy, or just plain corrosive.

How, then, can the manufacturer of this pump—Bruner Corporation, Milwaukee—offer a "lifetime guarantee" that this housing won't rust or corrode?

Reason: it's molded of phenolic. No ordinary phenolic, but a high-impact glass-filled material, Durez 16771.



This phenolic permits close tolerances, because there's little or no molding shrinkage. The pump housing is rugged enough to support a 1/2-hp motor mounted over the center opening, and a 1 1/4" discharge pipe screwed into the hole at upper left. Corrosion tests of the housing indicate it will outwear all common metals, including stainless steel.

We're betting it won't be hard for you to think of places where you can use a super-tough, easily molded plastic like this. To help you do so, we've made available a 4-page illustrated bulletin, "Designing High-Impact Phenolic Molded Parts." It gives design rules based on latest experience. Use coupon to request a copy.

For more information on Durez materials mentioned above, check here:

- ☐ "Facts on Phenolics"—pocket guide lists properties of typical Durez molding compounds.
- ☐ "Designer's Data File" describes uses, advantages of Hetron polyester.
- ☐ "Designing High-Impact Phenolic Molded Parts"—4-page illustrated bulletin.

Check, clip, and mail to us with your name, title, company address.

## DUREZ PLASTICS DIVISION

2111 WALCK ROAD, NORTH TONAWANDA, N. Y.

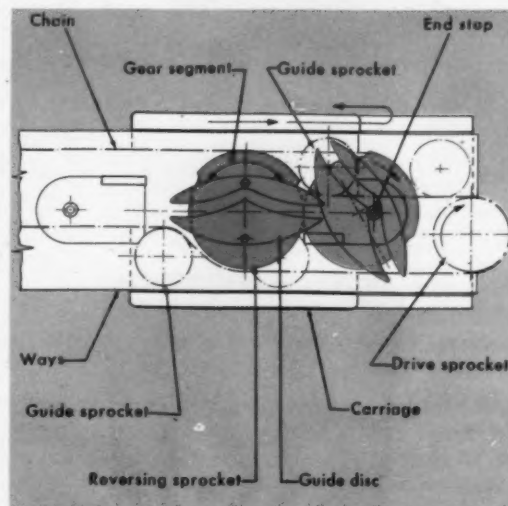
HOOKEER CHEMICAL CORPORATION



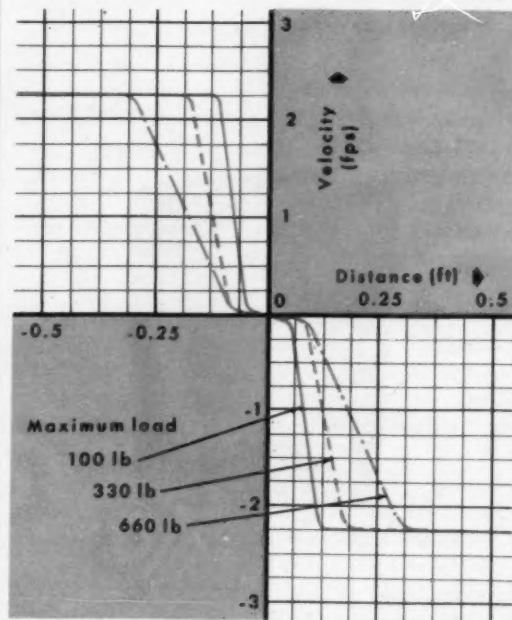
## IDEAS...MECHANICAL

## Chain Drive Generates

R. F. Stengel, German Editor



GUIDE DISC, reversing sprocket, chain drive and function of end stops.

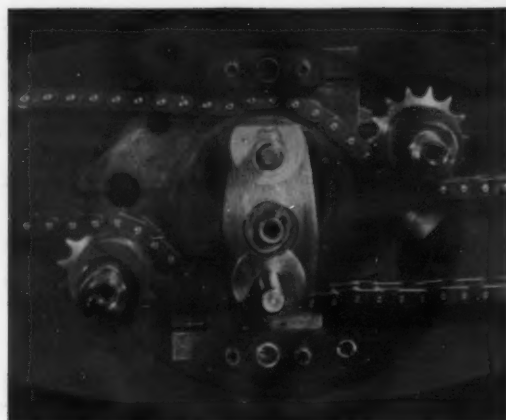


DISTANCE-VELOCITY DIAGRAM near reversing point.

Circle 29 on Reader-Service Card for more information



## Reciprocating Motion



A chain-drive transmission converts rotary motion into constant-speed reciprocating motion. Key elements are a slotted guide disc and a reversing sprocket which is geared over one-half of its circumference.

Both reversing sprocket and guide disc are coupled to a carriage moving horizontally or vertically on a bed with parallel ways. The bed carries movable end stops with projecting pins to limit the carriage stroke and the sprockets over which the driving chain runs.

In forward direction, the geared part of the reversing sprocket is up and is engaged by the chain whose returning stringer clears the bottom edge of the reversing sprocket. As the carriage nears the forward end stop, the projecting pin enters the slot of the guide disc.

While the pin moves along the approximately wave-shaped slot, the guide disc is turned accordingly, disengaging the coupling between reversing sprocket and carriage until the sprocket has rotated through 180 deg. Its geared part is now down to engage the returning stringer, which moves the carriage through the back stroke.

Because of the shape of the guide disc slot, reversal of carriage motion follows an approximately sinusoidal time-distance relationship and is accomplished without abrupt velocity changes.

The transmission is manufactured by Arnold & Stolzenberg GmbH, Einbeck near Hannover, Germany, in three sizes for 100-, 330- and 660-lb maximum force. Top velocity is 5 fps. Largest present installation has 26-ft stroke, adjustable within 0.008 inch.

# CHRYSLER POWER

**KEEPS ON WORKING  
AFTER OTHER ENGINES  
HAVE QUIT...**

Chrysler Industrial Engines—famous for long life and trouble free performance in the toughest applications—are now powering more, different applications than ever before. Why? Because Chrysler M & I is now offering more models than ever before. Thirty different engines—both gasoline and diesel—all backed by the industry's fastest and best field service network and warranty—all priced to reflect the mass production capacity of Chrysler Corporation.

**CHRYSLER**

MARINE AND INDUSTRIAL ENGINE DIVISION • CHRYSLER CORPORATION • DETROIT 31, MICHIGAN

## 30 CHRYSLER INDUSTRIAL ENGINE MODELS (24 Gasoline; 6 Chrysler-Parkus Diesel)

MODEL (Gasoline)	NO. CYL.	DISP. (Cu. In.)	WEIGHT (lbs.)	GROSS TORQUE (Fl. Lbs.)			GROSS HORSEPOWER			CONTINUOUS H.P. @ recommended rpm*
				@ 1200 rpm	MAX.	@ Rated rpm*	@ 1200 rpm	@ Peak Torque	Rated*	
H-170	6	170	420	148	130 @ 1600	136 @ 4000	34	46 @ 1600	104 @ 4000	48 @ 2800
HB-170	6	170	420	148	150 @ 1600	136 @ 4000	34	46 @ 1600	104 @ 4000	48 @ 2800
HC-170	6	170	420	148	150 @ 1600	136 @ 4000	34	46 @ 1600	104 @ 4000	48 @ 2800
IND. 30	6	230	575	190	190 @ 1200	144 @ 3600	43	43 @ 1200	99 @ 3600	73 @ 2800
IND. 31	6	230	610	190	190 @ 1200	144 @ 3600	43	43 @ 1200	99 @ 3600	73 @ 2800
IND. 931†	6	230	610	179	180 @ 1500	156 @ 3200	41	48 @ 1500	95 @ 3200	73 @ 2800
IND. 32	6	265	740	225	225 @ 1200	175 @ 3600	51	51 @ 1200	120 @ 3600	88 @ 2800
IND. 33	6	265	760	225	225 @ 1200	175 @ 3600	51	51 @ 1200	120 @ 3600	88 @ 2800
IND. 90BA†	6	251	760	196	197 @ 1300	167 @ 3200	45	49 @ 1300	101 @ 3200	78 @ 2800
H-225	6	225	475	204	204 @ 1200	157 @ 4000	47	47 @ 1300	119 @ 4000	61 @ 2800
HB-225	6	225	475	204	204 @ 1200	157 @ 4000	47	47 @ 1300	119 @ 4000	61 @ 2800
NC-225	6	225	475	204	204 @ 1200	157 @ 4000	47	47 @ 1300	119 @ 4000	61 @ 2800
H-318	8	318	550	256	269 @ 2400	246 @ 4000	60	125 @ 2400	187 @ 4000	84 @ 3200
HB-318	8	318	550	256	269 @ 2400	246 @ 4000	60	125 @ 2400	187 @ 4000	84 @ 3200
NC-318	8	318	550	256	275 @ 2400	252 @ 4000	62	130 @ 2400	191 @ 4000	90 @ 3200
HT-318	8	318	550	258	275 @ 2400	250 @ 4000	60	125 @ 2400	190 @ 4000	96 @ 3200
H-361	8	361	610	299	326 @ 2400	275 @ 4000	69	149 @ 2400	210 @ 4000	101 @ 3200
HB-361	8	361	610	314	334 @ 2400	265 @ 4000	70	151 @ 2400	205 @ 4000	110 @ 3200
HC-361	8	361	610	311	335 @ 2400	290 @ 4000	73	155 @ 2400	218 @ 4000	110 @ 3200
HT-361	8	361	710	316	336 @ 2000	262 @ 4000	72	128 @ 2000	200 @ 4000	142 @ 3200
H-413	8	413	625	346	384 @ 2600	324 @ 4000	82	190 @ 2600	248 @ 4000	127 @ 3200
HB-413	8	413	625	342	370 @ 2400	290 @ 4000	76	170 @ 2400	218 @ 4000	160 @ 3200
HC-413	8	413	625	345	394 @ 2400	333 @ 4000	87	183 @ 2400	255 @ 4000	160 @ 3200
HT-413	8	413	730	344	372 @ 2000	284 @ 4000	78	142 @ 2000	215 @ 4000	154 @ 3200
Four 99	4	99	330	73	82 @ 2100	69 @ 4000	17	32 @ 2100	52 @ 4000	34 @ 3000
Three 144	3	144	456	120	120 @ 1250	100 @ 2400	27	29 @ 1250	45 @ 2400	33 @ 2000
Four 203	4	203	520	163	164 @ 1000	120 @ 3000	39	32 @ 1000	71 @ 3000	47 @ 2000
Four 270	4	270	722	222	223 @ 1300	210 @ 2000	51	55 @ 1300	80 @ 2000	57 @ 2000
Six 305	6	305	702	242	247 @ 1000	176 @ 3000	57	37 @ 1000	102 @ 3000	71 @ 2000
Six 354	6	354	836	300	237 @ 1150	245 @ 2800	70	88 @ 1500	130 @ 2800	85 @ 2000

\* Send for detailed specifications, power charts, installation drawings on any model.

\* Ratings shown are for standard specifications

† Military QPL Engines

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# ONE STANDARD SCREW REPLACES MOST THREAD-CUTTING AND THREAD-FORMING SCREWS



Patent  
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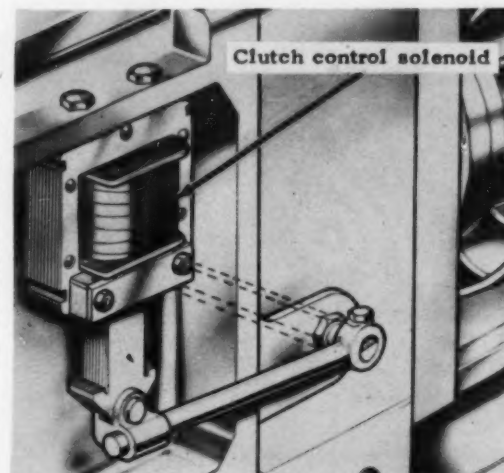
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## IDEAS...MECHANICAL

### Screw and Nut Speed Differential

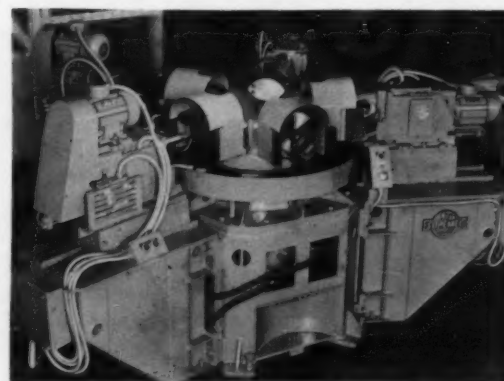
George B. Bernard, Correspondent in France



The feed of a tool turret is controlled by the speed differential between a feed screw and nut. The nut is gear driven and supported in bearings, which in turn are mounted in the machine's frame. Clutches engage and disengage, respectively, the screw and gear cylinder driving the nut.

The simple system allows precise control of both forward and reverse motions of the turret by using only the tool-drive motor. The turret can be locked in any position.

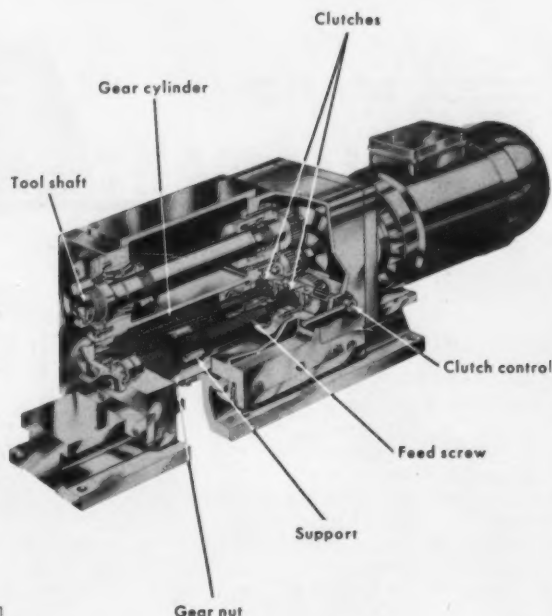
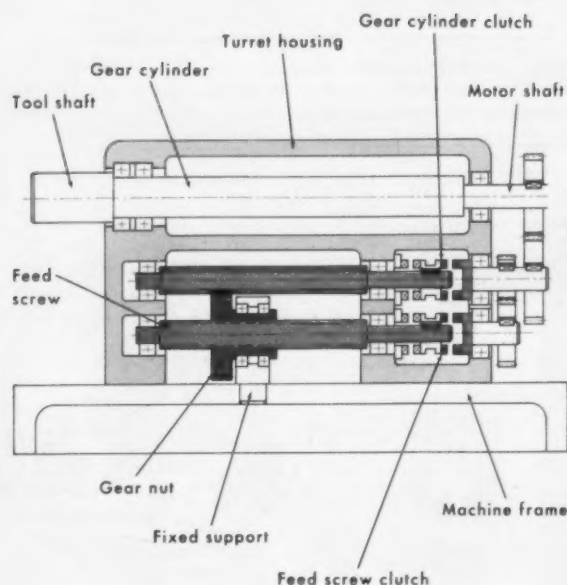
The units were designed and are manufactured by Constan Co., Juvisy, France.



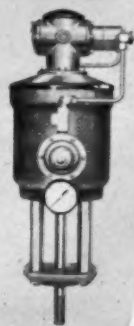
FOUR TURRETS accomplish finishing operations on automobile generator drive pulley. First turret bores shaft bore, second turret surfaces both flanges. Third turret finishes bore while last turret mills slot for drive key.

Circle 31 on Reader-Service Card for more information

## Controls Feed of Tool



NUT turns in ball bearings, mounted in fixed support attached to machine frame. Feed screw and gear cylinder are part of turret, are driven through clutches from tool-drive motor. Speed differential between nut and feed screw controls rate of feed. Turret is locked in fixed position when both clutches are disengaged. Clutches are operated by solenoids.



**SWITCH TO  
AUTOMATIC  
THROTTLING  
CONTROL FOR...**

**VALVES  
PROPORTIONING PUMPS  
VARIABLE SPEED DRIVES  
ETC.**

Conoflow Series 50 Cylinder Conomotor is widely used on control valves, butterfly valves, pulp stock valves, proportioning pumps, motor driven speed changers, rheostats, etc. It provides automatic throttling control for these and many other types of processing equipment previously limited to manual operation. The Cylinder Conomotor is a powerful, fast, pneumatic actuator capable of matching today's high-performance instrument systems.

Bore diameters from 3" to 12.5". Travels to 24". Develops thrusts better than 12,000 lbs. in either direction. Holds loads to within .002" per inch of stem travel. Look into its potential for your equipment.

Write for Bulletin B-50.

CC 108



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Miniature "MONOBALL"® self-aligning, plain and rod end bearings are now available in volume! The "BMP" Series was developed in 1949 and has been used in a wide variety of small precision assemblies demanding high performance and long life with minimum size and weight. Available only in stainless steel.

Consultation is invited. Southwest's newly expanded Research and Development Facility staff can design special types for your particular problem. Write for Bulletin No. 461. Address Dept. DN-61.

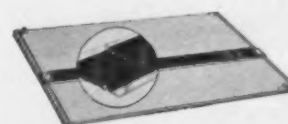
U. S. PATENTS NOS. 2626841, 2724172 and others. All World Rights Reserved.

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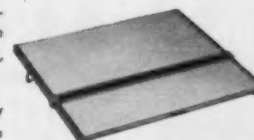
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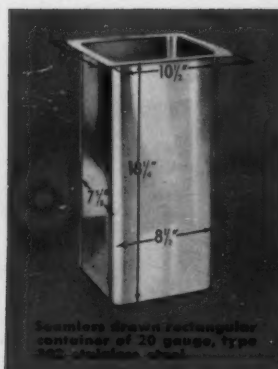
- 1 Stainless Steel Ball and Race { For types operating under high temperature (800-1200 degrees F.).
  - 2 Chrome Alloy Steel Ball and Race { For types operating under high radial ultimate loads (3000-893,000 lbs.).
  - 3 Bronze Race and Chrome Steel Ball { For types operating under normal loads with minimum friction requirements.
  - 4 "Dyflon"® Plastic Alloy Inserts, CRES Ball and Race, Chrome Alloy Steels. { For types operating under rotational, high radial loads and long cycle life where lubrication is impossible.
- Thousands in use. Backed by years of service life. Wide variety of Plain Types in bore sizes 3/16" to 6" Dia. Our engineers welcome an opportunity of studying individual requirements and prescribing a type or types which will serve under your demanding conditions. Southwest can design special types to fit individual specifications. Write for Engineering Manual No. 551. Address Dept. DN-61.

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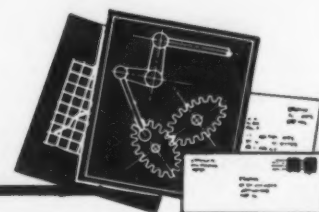


## Polar Ware Co.

4200 Lake Shore Road—Sheboygan, Wisconsin

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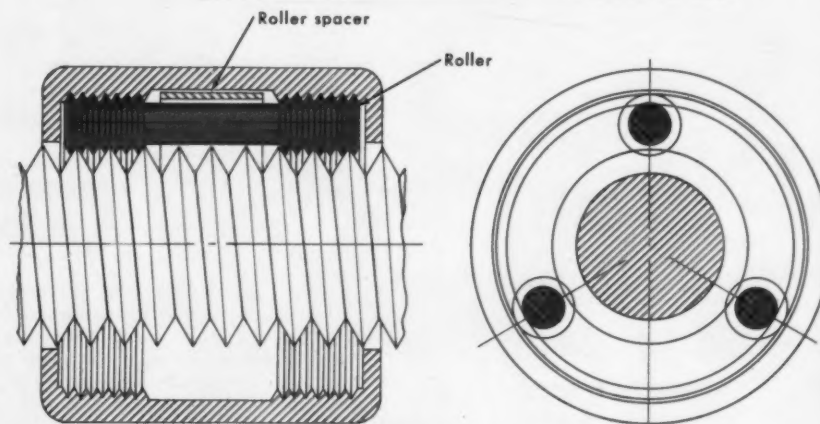
## IDEA MART DESIGN NEWS



AVAILABLE

### Rotary Linear Actuator

Purpose of this design is to provide low-friction linear nut action on a standard screw thread. Three rollers, which surround the screw, are spaced at 120 deg for self-centering. Each roller has one-third the pitch of the main screw or worm. Because the actuator is able to overrun its normal travel, it may be used in many mechanical operations. When the nut comes to a stop, further rotation of the screw causes rollers to wipe in their grooves. Write IM 535, Idea Mart, DESIGN NEWS, 3375 S. Bannock, Englewood, Colo.

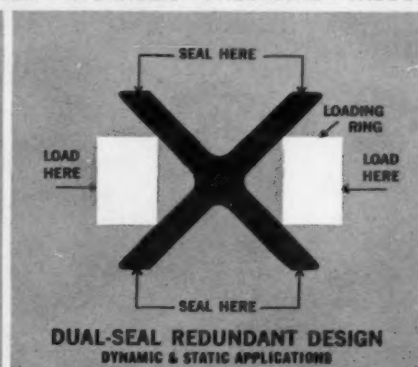
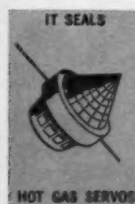


Ideas described in this department are in various stages of development and may be at any point from "initial concept" to "patented".

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TWX 1403U, Phone AN 9-0181



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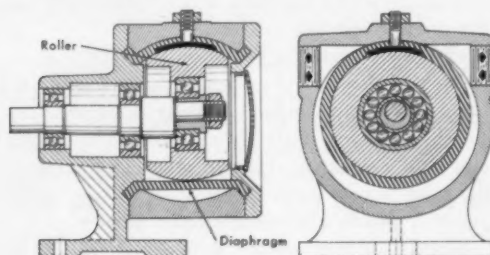
DESIGN NEWS—NOVEMBER 10, 1961



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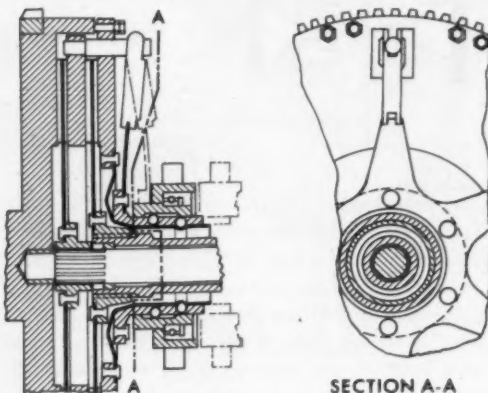
### Roller Diaphragm Pumps

A series of roller diaphragm pumps has been designed in which there are no mechanical moving parts in contact with liquid or chemical pumped. It is not possible to damage the pump even though abrasive slurries, reactive liquids and similar fluids are being pumped. Rubber or synthetic rubber tube, depending on material to be pumped, is installed in a cylinder block. Tube is under end pressure, with ends of tube flanged outward to effect a seal at each end and to cause the tube to be forced inward to increase suction efficiency. Center periphery is depressed by an idler roller which actuates the diaphragm against the pump cylinder casing. The pressure contact and wear may be adjusted by an eccentric mounting of crank. Radius of the cylinder prevents sharp flexing of diaphragm. Inlet and discharge are gradual and do not transmit shock loads to bearings. The ball bearings are the only mechanical moving parts, assuring quiet operation. Write IM 536, Idea Mart, DESIGN NEWS, 3375 S. Bannock, Englewood, Colo.



### Double Clutch

Either the forward or reverse clutch may be engaged in this double-disc unit. The unique actuating mechanism locks the clutch into engagement. The clutch throwout bearing is subjected to no load during engagement or disengagement. Bearing is loaded only during shifting. The unit is suited particularly for use in farm tractors or power take-off applications. Two separate center plates may be employed as well as two separate shift sleeves similar to the one shown. The design then becomes a clutch, both halves of which may be engaged simultaneously or individually engaged and disengaged. Patent license available. Write IM 537, Idea Mart, DESIGN NEWS, 3375 S. Bannock, Englewood, Colo.



SECTION A-A

## New Model FRACTIONAL HORSEPOWER DYNAMATIC AJUSTO-SPEDE® DRIVE



### Steps up Reliability and Durability

New in design but a veteran of proven dependability, the Eaton-Dynamatic Fractional HP Ajusto-Spede Drive offers a compact, low cost solution to adjustable speed control problems. Improvements include:

- Longer operating life • More uniform cooling
- Less noise and vibration • Lighter weight • Compact design

The Ajusto-Spede Drive offers advantages not found in other methods of control. It is low in cost and easily installed. It is an integral combination of AC constant speed induction motor, eddy-current couplings, and single tube, electronic control. Special control functions, such as acceleration, inching, threading, cascading of multiple units, follower operation, constant tension and clutch motor operation can be provided by remotely mounted electronic controls.

Ajusto-Spede Drives operate on standard 115/230 volt, single phase, 60 cycle or 220/440 volt, 3 phase, 60 cycle alternating current. No special power source is required. Available from the manufacturer or from your nearest Dynamatic Distributor in sizes of 1/4, 1/2, and 3/4 HP at 1600 RPM and 1/2, 3/4, and 1 HP at 3200 RPM. Can be supplied with either of two types of electromagnetic friction brakes and integral speed reducer in a wide variety of gear ratios.

Send for Illustrated Descriptive Literature

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MANUFACTURING COMPANY  
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### ... consider the advantages of **ALITE**

If you are designing a new product, or seeking new ways of improving existing ones, designing for Alite high-alumina ceramic may be your most profitable approach.

Because of its unique physical, chemical and electrical properties, this rugged and versatile material has proved successful in many highly critical applications, thus solving difficult design and production problems in a wide range of industrial fields.

Alite withstands high heat, shock and abrasion. Permits you to design for higher temperatures and greater strength. It can be supplied in practically any shape, finished to exacting tolerances. Alite has excellent properties for use as bushings, bearings, valve seats, pump parts, wear plates, wire guides, spools and cores. Any job that demands high mechanical strength and wear resistance, chemical resistance, or reliable performance at elevated temperatures, is a possible application for Alite.

#### Important **ALITE** properties

- Extremely hard, strong, chip-resistant
- Chemically inert—superior corrosion resistance
- Vacuum-tight—can be metallized and brazed to metal for hermetic seals
- High thermal shock and heat resistance—working temperatures to 1725°C.
- Remains stable under nuclear radiation
- Superb dimensional stability
- Excellent dielectric characteristics

For complete description of Alite, plus data on Alite Ceramic-to-Metal Seals, write for Bulletins A-8 and A-40R.



**U. S. STONEWARE**

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**ALITE DIVISION**

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## PATENTS

### Torque Control Means

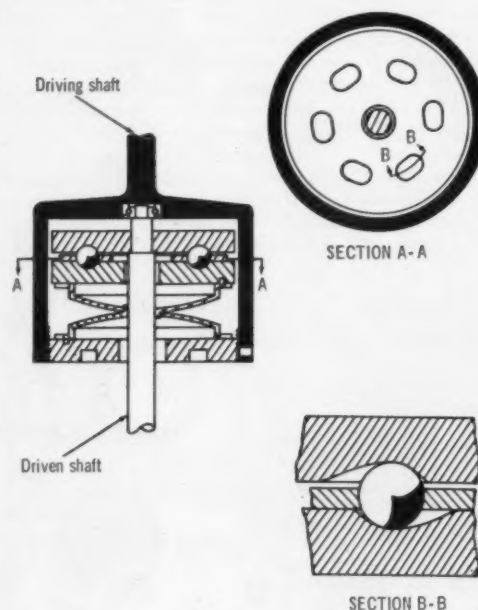
U. S. Patent 2,983,121;  
George R. Naas, Scottsville, N. Y.

Designed to limit torque force transmitted from one shaft to another, this device is suitable for hand tools, machinery shafting, instrument control knobs and similar applications. The driving shank is formed with an annular-cup flange. The driven shank is centered relative to the driving shank and is held by a thrust-type ball bearing.

One disc is pinned to the driving shank while a second disc is positioned below the first. The second disc is not directly connected to the driven shaft, but is free to turn about it. Two Belleville-type springs are positioned between the second disc and a lower face disc which screws into the cup-shaped housing.

The lower surface of the first disc and the upper surface of the second disc have several indentations in a circular pattern. Indentations are elongated and have a relatively steep shoulder on one end, and a relatively gradual slope on the other. Balls are placed between the discs and are maintained in position by a perforated cage ring.

When overload torque is reached, the balls tend to cam the second disc against the force of the Belleville-type springs. Balls then leave the indentations and roll into the space between the flat face portions of the two discs.

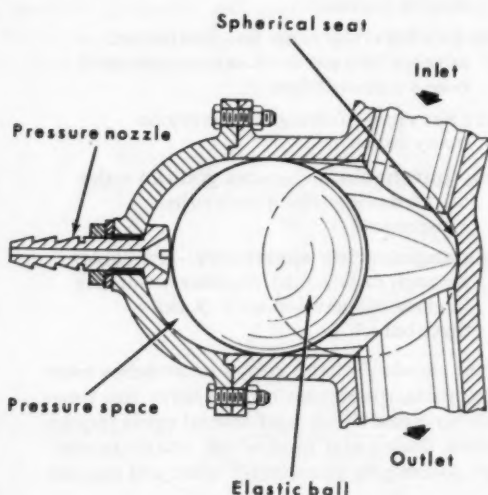


## Servo valve

French Patent 1,245,398; Maurice Legland,  
Lille, France.

This patent covers a pressure-actuated valve designed for low cost and long life, and claimed capable of controlling fluids carrying considerable amounts of solids.

An elastic ball of rubber or plastic moves between two positions in its housing. In one position, the ball bears on a spherical seat containing both inlet and outlet ports, closing them off. Inlet and outlet are offset from the valve center, so that when the valve is opened, fluid flow rotates the ball.



In the open position, the ball is controlled by a nozzle which varies pressure behind the ball. If this pressure is slightly higher than the inlet pressure (which is higher than the outlet pressure), resultant force on the ball causes it to move and close the valve. If, on the contrary, nozzle pressure decreases below outlet pressure, the resultant pressure force on the ball causes it to open the valve.



175° F. sand, being blown to storage, regularly wore through special abrasion-resistant alloy steel wear plates at duct elbows in only 2 months.



Abrasive sand finally gnawed through ADIPRENE® urethane rubber liner in elbows—but it took 6 months.

## Foundry finds ADIPRENE® outwears steel 3 to 1

This interesting application shows dramatically how tough ADIPRENE urethane rubber really is. And designers are finding that this outstanding abrasion resistance . . . plus excellent load bearing capacity and low temperature resistance . . . is the solution to many design problems.

For example, industrial wheels made of ADIPRENE are outlasting those made of ordinary rubber 5 to 1. A leading auto manufacturer is using ADIPRENE for longer lasting ball joint seals. Manufacturers in both civilian and defense industries use ADIPRENE for impact, shock and abrasion resistant mounts, bumpers, bushings, suspension straps. A metalworking company is employing ADIPRENE as a female stamping die . . . finds that it survives 50,000 impacts as compared to only 400 for ordinary rubber. From "potting" to pulleys . . . from shoe heels to shock resistant grinding wheels . . . ADIPRENE's unique set of properties can help you design better, longer lasting new products. For more information about ADIPRENE write E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Dept. DN-11, Wilmington 98, Delaware.



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THRU UNOBSTRUCTED  
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TO FLOW PASSAGES

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Standard Valve Catalog 60-61



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**barksdale valves**

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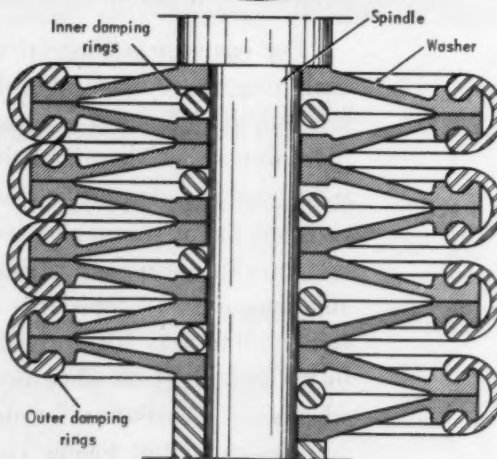
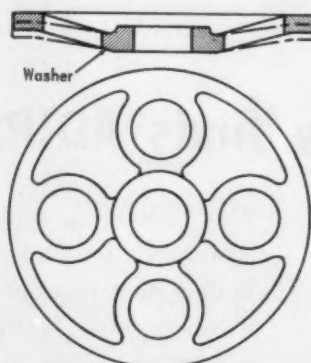
## PATENTS

### Resilient Washers

British Patent 857,611; Regie Nationale des Usines  
Renault, 8/10 Avenue Emile Zola  
Billancourt (Seine), France.

Stacks of cambered washers, molded from polyamide  
(nylon) resin, are mounted on a spindle to function  
as a spring. Washers are placed in pairs, successive  
washers arranged with their cambers reversed.

Manufactured by molding, the washers can be  
given the optimum shape to suit a given purpose.  
Generally, each washer has a stiffened center and



outer rib. These flat, raised portions make contact  
at maximum pressure and protect the web from  
strain. The washers can replace Belleville-type dished  
washers, punched from sheet steel, which lose re-  
silience after high compression. Damping effect is  
improved by fitting circular cross-section rubber  
rings between the washer centers, and tire-shaped  
rubber rings around outer rims of each pair.

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les Clayes-sous-Bois (S. et O.), France.

**CLARE**

Relays and Related Control Components

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DESIGN NEWS—NOVEMBER 10, 1961

## Fluid Control Valve

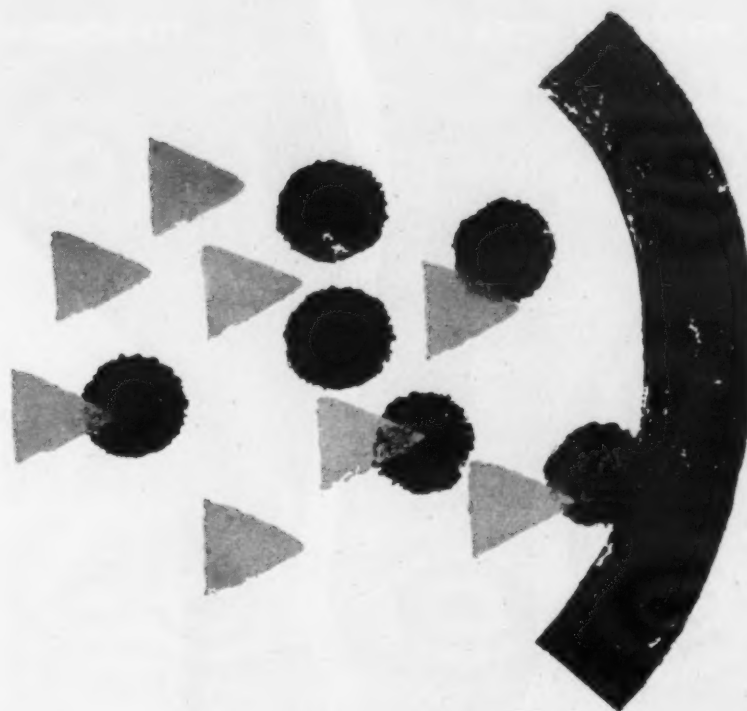
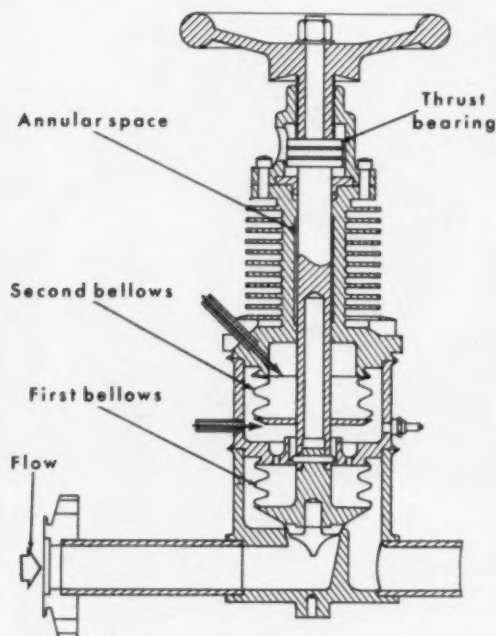
British Patent 869,101; Christopher Elderfield, Hawker Siddeley Nuclear Power Co., Ltd., Sutton Lane, Langley, Buckinghamshire, England.

This valve uses duplicate bellows glands and an air-cooled plain gland to prevent accidental escape of radioactive liquid metal. A further safeguard is provided by utilizing escaped metal to seal off the valve.

Should the first bellows fail, the second stops liquid metal escape. Simultaneously, spark plug electrodes fitted in the casing between the first and second bellows are bridged by liquid metal. An electric circuit is completed to operate a visual/audible warning signal.

If the second bellows also fails, liquid metal passes between the casing and valve operating shaft periphery to enter an annular space, where flow is restricted by the plain gland. During passage up the space, where the casing cooling fins assist heat dispersal, the metal is cooled and solidified. Continued escape is thus effectively stopped.

The liquid metal controlled by the valve is at high pressure. To reduce pressure differential across the first bellows, pressurized inert gas is supplied through a conduit to the bellows interior. This pressure application sets up a pressure differential across the second bellows which is relieved by supplying pressurized gas to the second bellows.



**Said Michael Faraday:** "The amounts of different substances deposited or dissolved by the same quantity of electricity, are proportional to their chemical equivalent weights."

Increasing requirements for pure, very thin films—especially those of ferro-magnetic elements and alloys—have become critical. To break this bottleneck, one production method under investigation is a chemical process from an aqueous solution—using metallic salts and a reducing agent.

Scientists at Lockheed Missiles & Space Company have conducted some highly successful experiments, in which extremely pure and thin ferro-magnetic film was deposited on such material as glass and plastics.

Thin film deposition is but one of many phenomena now being investigated at Lockheed Missiles & Space Company in Sunnyvale and Palo Alto, California, on the beautiful San Francisco Peninsula. Engineers and scientists of outstanding talent and ability naturally gravitate to Lockheed. For here they can pursue their special fields of interest in an ideal environment.

A leader in the aerospace field, Lockheed is Systems Manager for such programs as the DISCOVERER, MIDAS, and other satellites, and the POLARIS FBM. Why not investigate future possibilities at Lockheed? Write Research and Development Staff, Dept. M-28A, 962 West El Camino Real, Sunnyvale, California. U.S. citizenship or existing Department of Defense industrial security clearance required. An Equal Opportunity Employer.

## LOCKHEED MISSILES & SPACE COMPANY

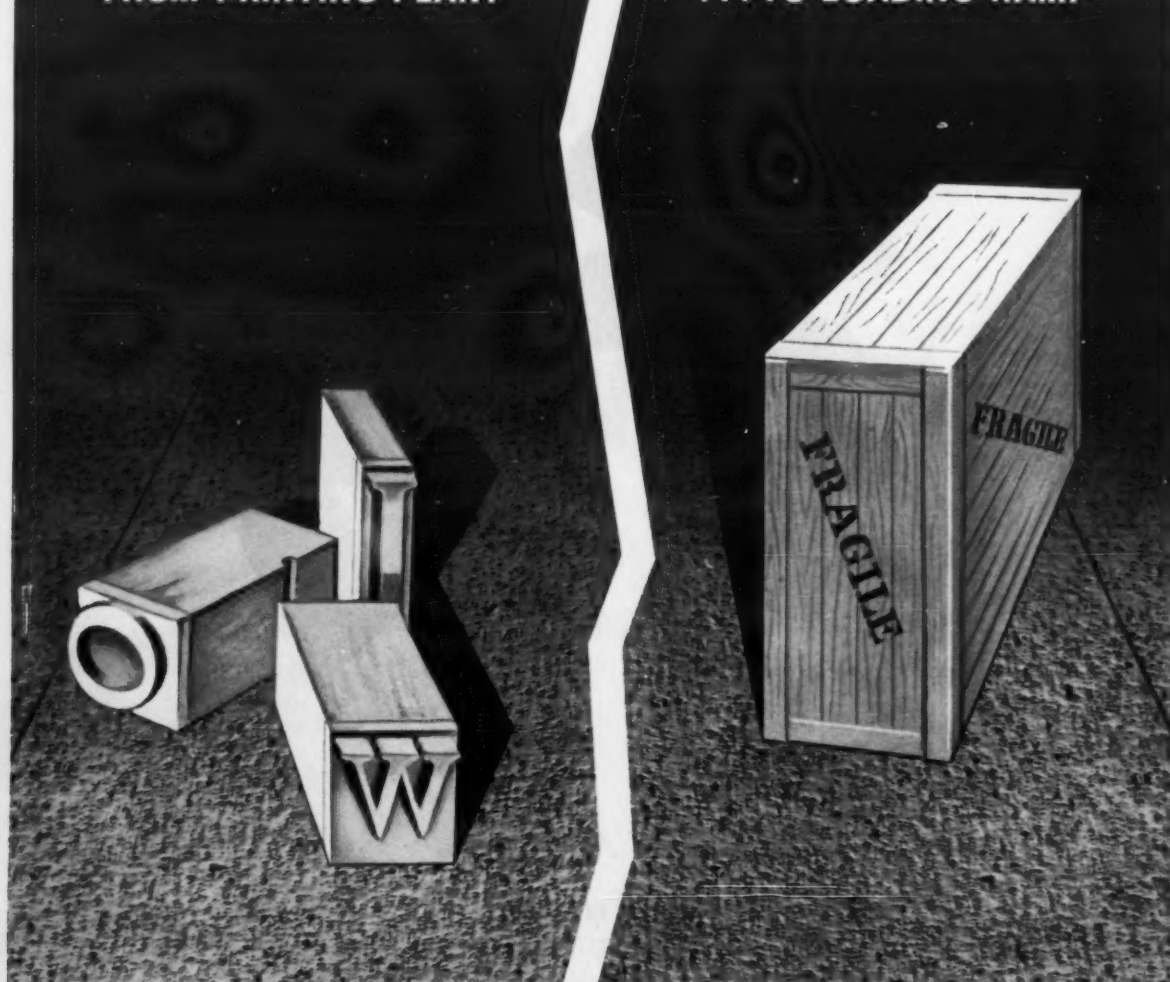
A GROUP DIVISION OF LOCKHEED AIRCRAFT CORPORATION

Systems Manager for the Navy POLARIS FBM and the Air Force AGENA Satellite in the DISCOVERER and MIDAS programs. Other current programs include SAINT, ADVENT and such NASA projects as OGO, OAO, ECHO, and NIMBUS.

SUNNYVALE, PALO ALTO, VAN NUYS, SANTA CRUZ, SANTA MARIA, CALIFORNIA • CAPE CANAVERAL, FLORIDA • HAWAII

FROM PRINTING PLANT

... TO LOADING RAMP



Abrasive particles are rolled densely and uniformly into high-quality steel and act as friction grips for safe footing.

## There's never a slip on **A.W. ALGRIP** (the only ABRASIVE rolled steel floor plate)

Step up your plant safety with Algrip—the world's only abrasive rolled steel floor plate. It provides safer footing where splashing water, grease, oil, ink mist or other slippery substances might otherwise pose serious plant hazards. Even on steeply inclined surfaces, Algrip creates firm traction for workmen's shoes and the wheels of rolling stock.

This high quality steel plate is light enough to use as flooring overlay and is strong enough for independent flooring. Fabrication is simple. You can shear, form, weld and drill it with standard shop equipment. Fire and chemical resistant, Algrip flooring is approved for safety by Underwriters' Laboratories. Write today for Bulletin AL-S3.



### ALAN WOOD STEEL COMPANY

Conschocken, Pa. • STEEL PRODUCERS WITH THE CUSTOMER IN MIND

DISTRICT OFFICES AND REPRESENTATIVES: Philadelphia • New York • Los Angeles • Boston • Atlanta  
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Montreal, Toronto and Vancouver, Canada: A. C. Leslie & Co., Ltd.



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## PATENTS

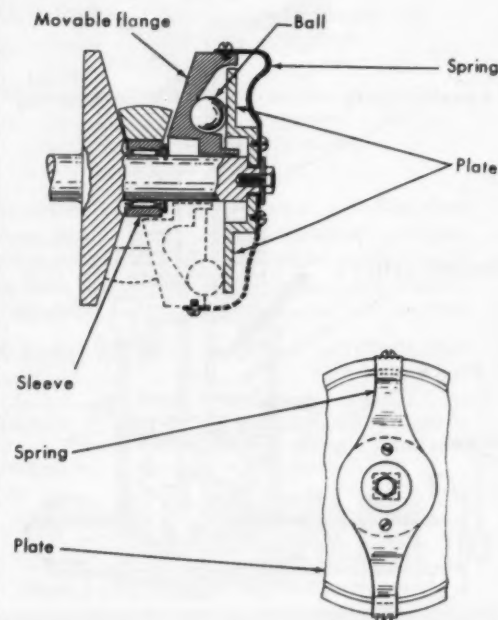
### Automatic Variable-Speed And Clutch Units

U.S. Patent 2,986,043; Eric Jaulmes, Paris, France, assignor to Ateliers de la Motobecane, Societe Anonyme Francaise, Pantin (Seine), France.

Object of this invention is to provide means by which an expanding pulley-type clutch may be controlled automatically without manual intervention, such as in conjunction with the starting of a small engine.

A fixed flange is integral with the motor shaft. A movable flange slides freely on the shaft but is connected to it for rotary movement. A plate and a blade spring are fitted on the squared end of the shaft and held by a bolt. The two ends of the blade spring are attached by screws to the periphery of the movable flange, the hub of which is formed with a recess to receive a sleeve mounted on a needle bearing.

A number of balls act as centrifugal members, bearing simultaneously against the inclined face of the movable flange and against the inner face of the plate. Suitable choice of thickness, cross-section and outline of the edges of the spring provide the desired characteristics. The function of an automatic clutch is provided by the additional travel of the movable flange and the addition of the blade spring, the action of which opposes the centrifugal balls.



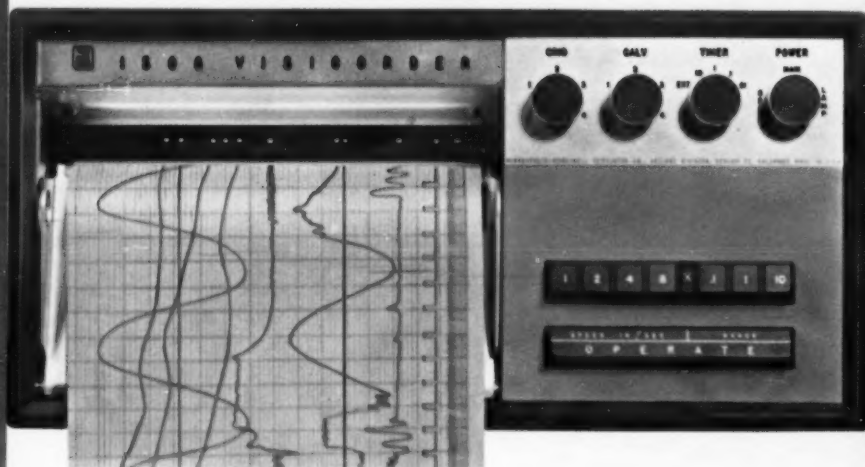
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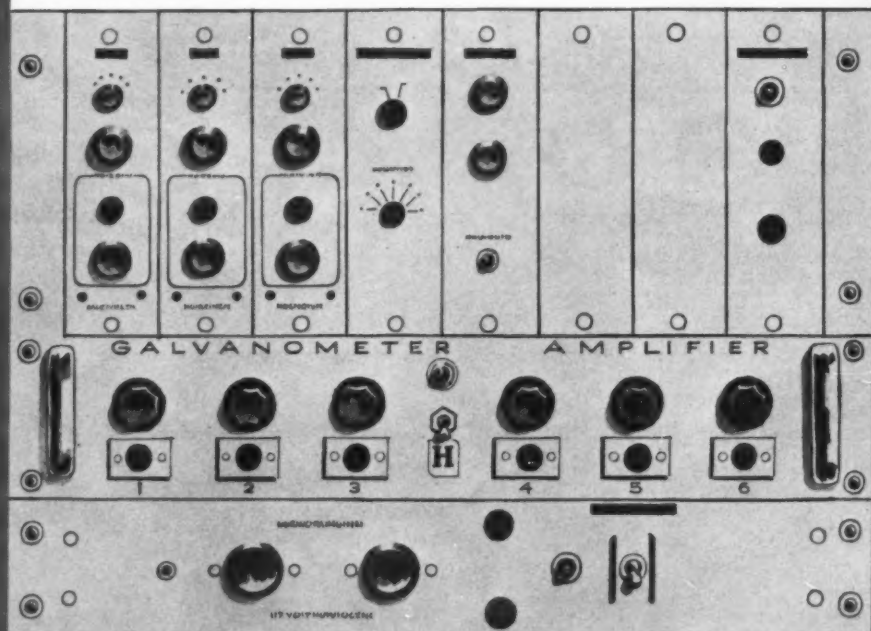
New...for systems use...the

## **Rack Mounted**

### **MODEL 1508 HONEYWELL VISICORDER OSCILLOGRAPH**



Specifically designed to fit in only 7 inches of rack height, the Model 1508 Visicorder Oscillograph gives you a wider record, a greater record speed range, and more recording channels in less rack space than any other recording oscillograph.





## Features of the Model 1508 Visicorder Oscillograph

Using the famous Visicorder direct-recording principle that was pioneered, developed, and introduced by Honeywell, the New Model 1508 oscillograph records up to 24 channels of information simultaneously, producing immediately readable analog records without ink, styli, heat, powders, or chemical processing. Yet it is extremely compact—occupying only 7 inches of height in its rack-mount version—with many automatic features and the convenience of pushbutton controls. It is also available in a bench-mount model.

### **Maximum Operating Convenience**

The 1508 has been designed for easy operation and service. 12 record speeds—from 0.1" through 80"/second—are push-button selected. All controls are handy on the front panel. You can load paper in seconds. In the rack model, the cover of the 1508 stays in the rack when the instrument is pulled

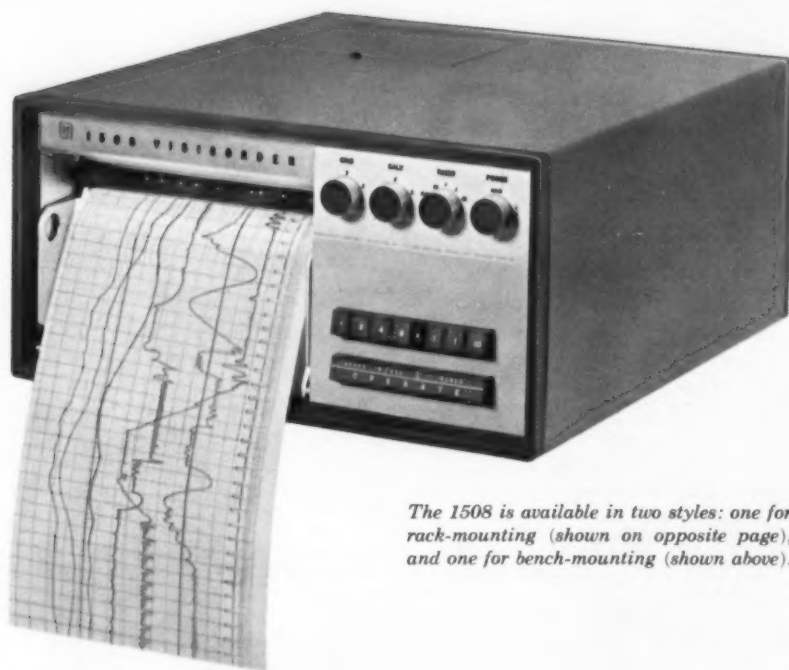
forward, thus providing complete accessibility for service, lamp and galvanometer adjustment. As in all Honeywell Visicorders, the actual recording spots are visible at the point of recording for precise galvanometer calibration and monitoring of information.

### **Solid, One-Piece Magnesium Casting**

To prevent outside stresses on the instrument from introducing recording errors, the 1508 optical system, magnet assemblies, and drive system are mounted on a solid, one-piece magnesium casting.

These design refinements and extra quality features are typical of the superior instruments that have established Honeywell's leadership in the field of oscillography.

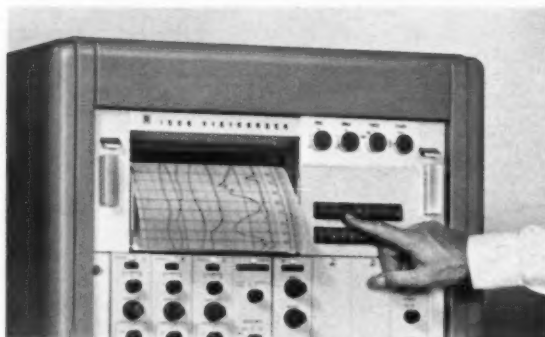
Ask your nearest Honeywell Field Engineer for a demonstration of the new 1508 Visicorder and other products described in these pages.



*The 1508 is available in two styles: one for rack-mounting (shown on opposite page), and one for bench-mounting (shown above).*



*The loading of recording paper into the 1508 is a simple process. The roll of paper drops easily into the receptacle with no need for threading.*



*All operating controls on the 1508 are located conveniently on the front panel.*

**Condensed Specifications**  
**Model 1508**  
**Visicorder Oscillograph**

**CHANNELS:** 12 or 24

**GALVANOMETERS:** type M, sub-miniature.

**RECORD WIDTH:** 8" (actual recording width 7 $\frac{3}{4}$ " ) with provision for narrower widths.

**RECORD LENGTH:** 100' standard, 150' extra-thin, 200' super-thin. Unused paper indicator.

**RECORD SPEEDS:** 12, push-button selected, as follows: 0.1, 0.2, 0.4, 0.8, 1.0, 2.0, 4.0, 8.0, 10, 20, 40, 80"/second, changeable during operation.

**FREQUENCIES:** DC to 5,000 cps.

**WRITING SPEEDS:** greatly in excess of 50,000"/second.

**TIME LINES:** 4-interval system with .01, 0.1, 1.0, and 10-sec. intervals. On-off switch; provision for external synchronization.

**GRID LINES:** 0.1" with 5th line heavy, or 2mm with 1 cm heavy. On-off and density control. Special scales available.

**OPTICAL ARM:** 11.8" (30 cm) standard in all Honeywell Visicorders.

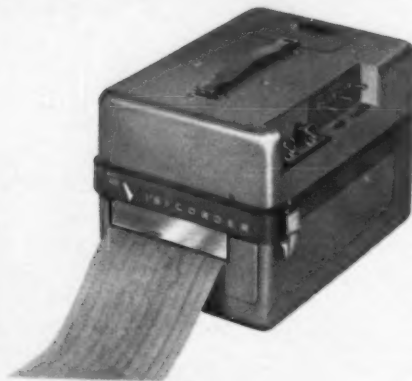
**TRACE IDENTIFIER:** 45° slope every 8", spaced .032" max., .02" min.

**POWER:** 117v 60 cycle; 230v 50 cycle; 5-6 amps at 117v.

**DIMENSIONS:** 19" wide x 7" high x 17 $\frac{1}{2}$ " deep excluding connectors and handles. Weight approximately 50 lb.



## Other Models of Honeywell Visicorder Oscillographs



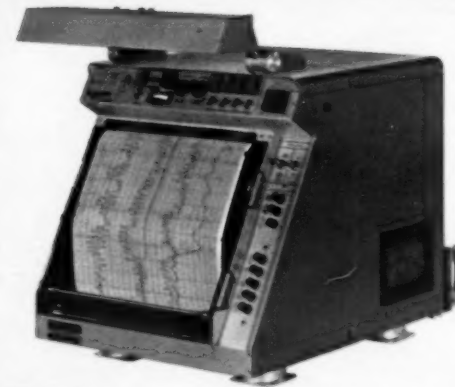
**MODEL 1406**...An efficient, dependable direct-recording oscillograph which makes the Visicorder principle available, on an extremely low-cost per channel basis, to users with recording requirements in the middle frequency range. Records up to 6 channels with special Type L Honeywell galvanometers.



**MODEL 906C**... with 8- or 14-channel capacity, built-in grid line and timing system, and self-starting lamp for remote operation. The built-in flash-tube timing system may be used normally or triggered externally.



**MODEL 1108**... an intermediate 24-channel instrument which fits logically between the 14-channel 906C models and the 36-channel model 1012. The 1108 has such extra features as automatic record length control, record reverse, record numbering, push-button record speeds and time-line intervals, and integral record take-up.



**MODEL 1012**... the ideal instrument for large-scale uses, the 1012 is the most convenient and versatile oscillograph ever built for directly recording as many as 36 channels of dynamic data. It includes all the automatic features of the Model 1108 and more besides.

### USES OF THE VISICORDER

Visicorder Oscillographs are useful as direct readout units in systems for either **RECORDING** or **MONITORING** of almost any type... in **CONTROL** applications to monitor reference and error signals... in **MISSILE and ENGINE ANALYSIS** for test stand recording... for analog recording of **TELEMETERED SIGNALS**... in **NUCLEAR TESTING** to record temperatures, pressures, impacts... in **LABORATORY** work for all-purpose analyses... in **PRODUCTION** for final dynamic inspection... in **COMPUTING** for immediately-readable analog records... in **PILOT TEST** for rapid examination of prototypes... in **ALL TESTS** which are non-repetitive in sequence where oscilloscopes are impractical.

Write for further details on the new Model 1508 Visicorder Oscillograph, or call us at SKYline 6-3681, Direct Distance Dialing Code 303 Minneapolis-Honeywell, Heiland Division, 5200 E. Evans Avenue, Denver 22, Colorado

### HONEYWELL INTERNATIONAL

Sales and Service offices in all principal cities of the world. Manufacturing in United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.

# Honeywell



*First in Control*

The following list compiled from recent issues of the Patent Gazette gives you increased coverage of new patents whose details may be useful to product and machine designers. Copies may be obtained from the U. S. Commissioner of Patents, Washington, D. C. The price is 25c each.

#### FLOW-CONTROL VALVE

U S Patent 2,999,512; Eugene V. Barkow, 681 Morris Turnpike, Springfield, N.J.

#### VARIABLE-SPEED DRIVE

U S Patent 2,999,574; Adiel Y. Dodge, c/o A.Y. Dodge Co., 206 S. Main St., Rockford, Ill.

#### SPRING CONSTRUCTION

U S Patent 2,999,677; Karl Schindler, Frankfurt am Main, Germany, assignor to Henschel-Werke GmbH, Kassel, Germany.

#### BALL AND SOCKET JOINT

U S Patent 2,999,708; Michael A. Dudash, Rochester, N.Y., assignor to General Motors Corp., Detroit, Mich.

#### SWITCH

U S Patent 2,999,912; George F. Kincaid, Bradley C. Douglas and Benjamin A. Gay, St. Louis, Mo., assignors to Atlas Powder Co., Wilmington, Del.

#### FLUID-OPERATED GOVERNOR

U S Patent 2,995,898; Robert H. Thorne, 3410 W. Chicago Blvd., Detroit, Mich.

#### RECIPROCATING DRIVE MECHANISM

U S Patent 2,995,941; Arthur B. Bassoff, Detroit, Mich.

#### ADJUSTABLE VALVE

U S Patent 2,996,048; Robert P. Rohde, Saginaw, Mich., and William B. Thompson, Newton Center, Mass., assignors to General Motors Corp., Detroit, Mich.

#### THREE-WAY VALVE

U S Patent 2,996,082; Robert G. Miner, La Crosse, Wis., assignor to The Trane Co., La Crosse, Wis.

#### SEAL APPARATUS

U S Patent 2,996,282; Miklos Sajben, Media, Pa., assignor to Westinghouse Electric Corp., East Pittsburgh, Pa.

#### SPLIT MECHANICAL SEAL

U S Patent 2,996,319; John C. Copes, 1435 New York St., New Orleans, La.



“We needed a special magnetic 78½% nickel alloy in .234" ± .003" diam. rod stock and .042" x 5/16" x 4' strips. We got it from Hamilton.”

says Robert Troxell, Relay Engineer, Cook Electric Company, Chicago, Illinois

**PRECISION IS OUR PROVINCE.** Working to minimum thickness of .00008", widths of ½", Hamilton can supply you with foil or strip—rod or wire—of virtually any alloy in production quantities. Our full-scale, completely-integrated facilities and engineering talent in this field permit absolute quality control from melt to finish. Thanks to these capabilities . . . a familiarity with precision work inherited from Hamilton's watchmaking background . . . experience with

ultra-thin foils unmatched anywhere in the world . . . we offer you precision metals to meet your exact property and delivery requirements. We guarantee our product. Call us.



For additional information on Hamilton's facilities and capabilities, send for free booklet, "Precision Metallurgical Services." Write Dept. 3611, Metals and Electronics Div., Hamilton Watch Co., Lancaster, Penna.

 **HAMILTON WATCH COMPANY**

Metals and Electronics Division, Lancaster, Penna.

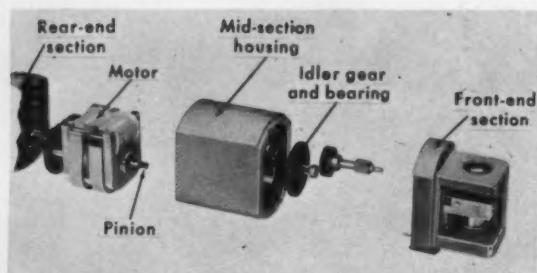
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## Stepping Motor and Relay Regulate Arc Length in Welding Head

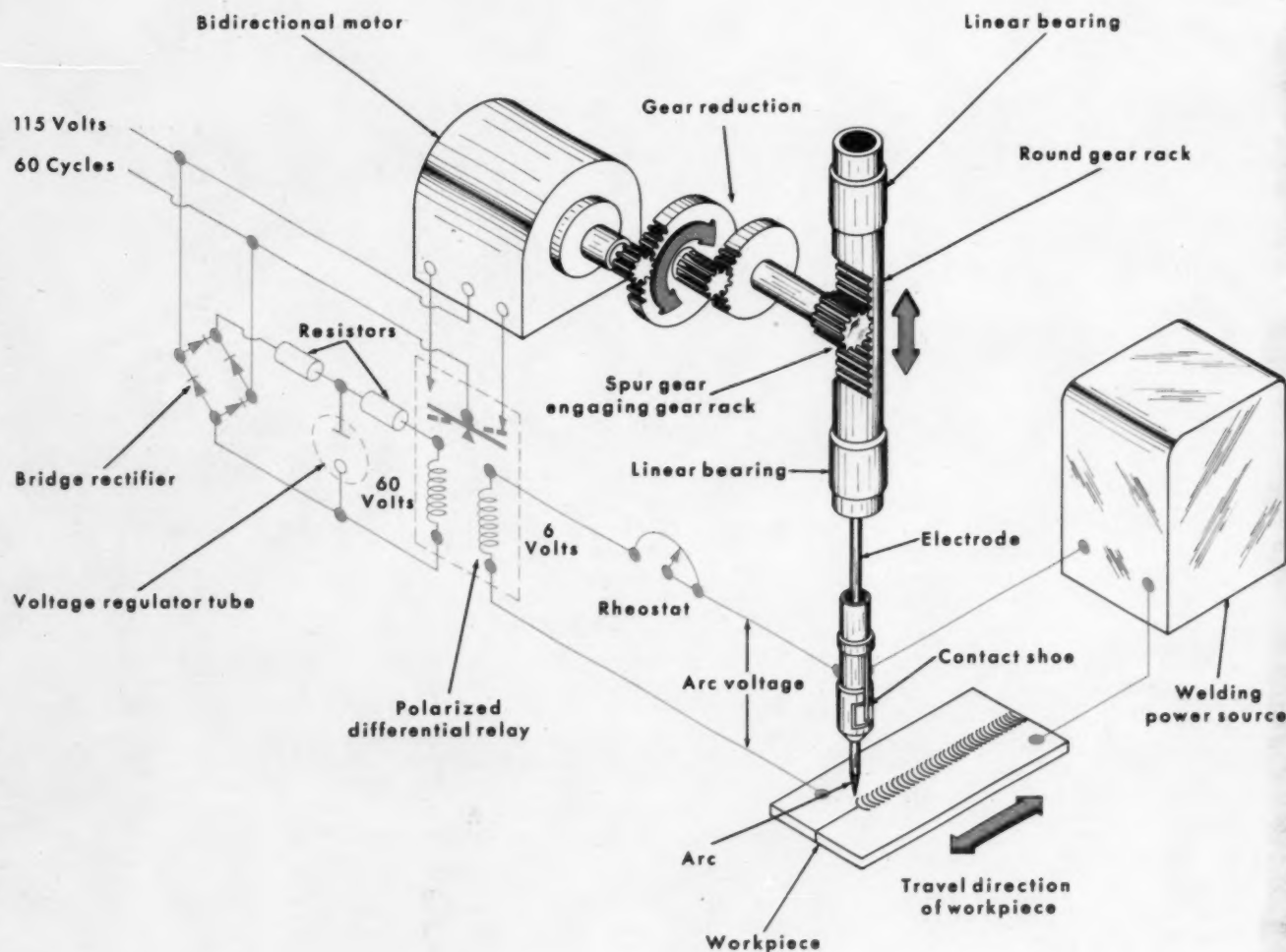
Victor W. Wigotsky, Eastern Editor



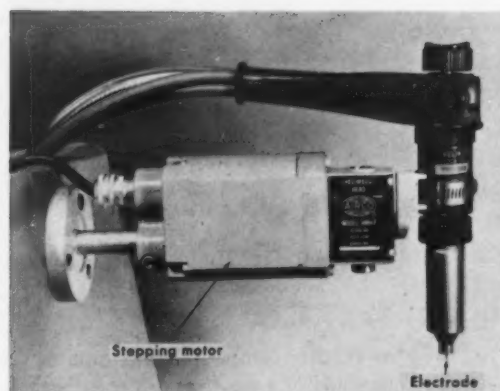
A stepping motor and a polarized differential relay regulate the arc length in a tungsten-inert gas welding head. The relay acts as voltage-sensing device which actuates a bidirectional stepping motor to maintain a null balance between a fixed reference voltage and the arc voltage. The essentially inertia-free characteristic of a stepping motor plus the simple method of voltage sensing results in an inexpensive automatic welding head without elaborate feedback components and circuitry.

In the tungsten-inert gas welding process, an electric arc is established between the nonconsuming tungsten electrode and workpiece. Electrode, arc and workpiece are shielded from oxidation by a stream of inert gas (argon, helium or a mixture of the two) from a nozzle surrounding the electrode. Arc length, a direct function of arc voltage, should be maintained constant to assure uniform heat penetration to the joint being welded.

OUTPUT OF BRIDGE RECTIFIER, through suitable filters, provides approximately 140v of unregulated d-c. Voltage regulator tube reduces this to stable 75v d-c which, through series resistor, provides constant 60v on reference coil of differential relay. Since opposing coil requires 6v to balance relay, difference between 6v and desired arc voltage is dissipated in adjustable rheostat. If arc voltage is higher than desired amount, as set by rheostat, more than 6v will appear across 6v coil of relay. This causes magnetic flux unbalance that tilts relay armature. Closing contact causes clockwise motor rotation. Rack movement (through gear reduction) lowers electrode until arc voltage results in 6v being impressed on 6v coil. Relay contact opens when balance is restored. If arc voltage becomes sufficiently less than desired amount, opposite action occurs so that electrode will move up until balance is obtained. Problem of transferring welding current to continuously adjustable electrode was solved by milling section out of side of piece of copper tubing, whose bore provided loose fit around electrode. Ceramic shoe is placed in milled-out tubing section and is spring biased to apply side pressure on electrode and establish line contact between electrode and tubing bore. Tubing is energized by welding power source.







UNIT PROVIDES INEXPENSIVE AUTOMATIC WELDING HEAD where extreme accuracy and positioning range are not required. All components that may require replacement are plug-in units to simplify maintenance. Printed circuitry in control system minimizes hand wiring. Machine can be serviced by nontechnical maintenance men. Manufacturing cost is about 1/3 that of electronically controlled units. Head is 6-5/8 inches long, 2-1/4 inches wide, 3-3/16 inches high and weighs less than 5 lb. Conventional head is approximately 10 by 14 by 14 inches.

Normally, systems employing conventional servomotors automatically adjust arc length in response to changes in arc voltage.

A fixed reference voltage is applied to one coil of the relay, while arc voltage is applied to the relay's other coil. Relay armature remains in a balanced midway position when magnetic flux produced by the two coils is equal. If, however, flux from the arc voltage coil is greater than that from the reference coil, the magnetic unbalance causes a pivoting of the armature to energize the motor in direction to shorten the arc length. Adjustment is through a pinion and rack mechanism connected to the electrode. If arc voltage is lower than the balanced condition, the relay armature pivots in the opposite direction so that counterrotation of the motor raises the electrode and increases the arc length. The desired constant welding condition thus is maintained.

A significant cost saving is achieved in the control section by using a high-voltage, low-current coil as the reference element. Arc voltage is applied to a low-voltage, high-current coil through a rheostat. Using a fixed-reference voltage of 60v to balance 6v on the arc voltage coil permits elimination of a transformer and use of an inexpensive voltage regulator tube. D-C to the VR tube is obtained from a bridge rectifier across the 115v line, with the two separate coils in the polarized differential relay providing electrical isolation between line and arc voltage.

The Heliweld automatic tungsten-inert gas welding head was designed by the Equipment Engineering and Development Dept., Air Reduction Sales Co., Union, N. J.

For Free Reprints of the Above Article,  
Circle 526 on Reader-Service Card

## DURAFLEX

**the more durable, ductile,  
flexible phosphor bronze—  
at no extra cost**

Here is a versatile new type of phosphor bronze. The superfine-grain structure of Duraflex provides a considerable improvement in fatigue life over regular phosphor bronze. An independently supervised laboratory test recently proved this. Three springs of regular Phosphor Bronze, 5% (A) took a permanent set at about 200,000 deflections and fractured at an average of 453,374 deflections. Four springs of DURAFLEX Superfine-Grain Phosphor Bronze, 5% (A) showed no permanent set, no loss of load and no breakage at 4,000,000 deflections.

This new, higher quality Anaconda phosphor bronze is now available in several standard phosphor bronze alloys—in strip metal up to 0.062" thick and up to 14" wide in all standard tempers, and in wire up to 3/16" diameter. Duraflex strip is also available in long rolls.

Within the capabilities of size and alloy composition, Duraflex strip and wire can be applied to the innumerable uses for which conventional phosphor bronzes are employed, and in most instances provide longer and more efficient service. Yet Duraflex sells for the same price as regular phosphor bronze in the same alloys and forms.

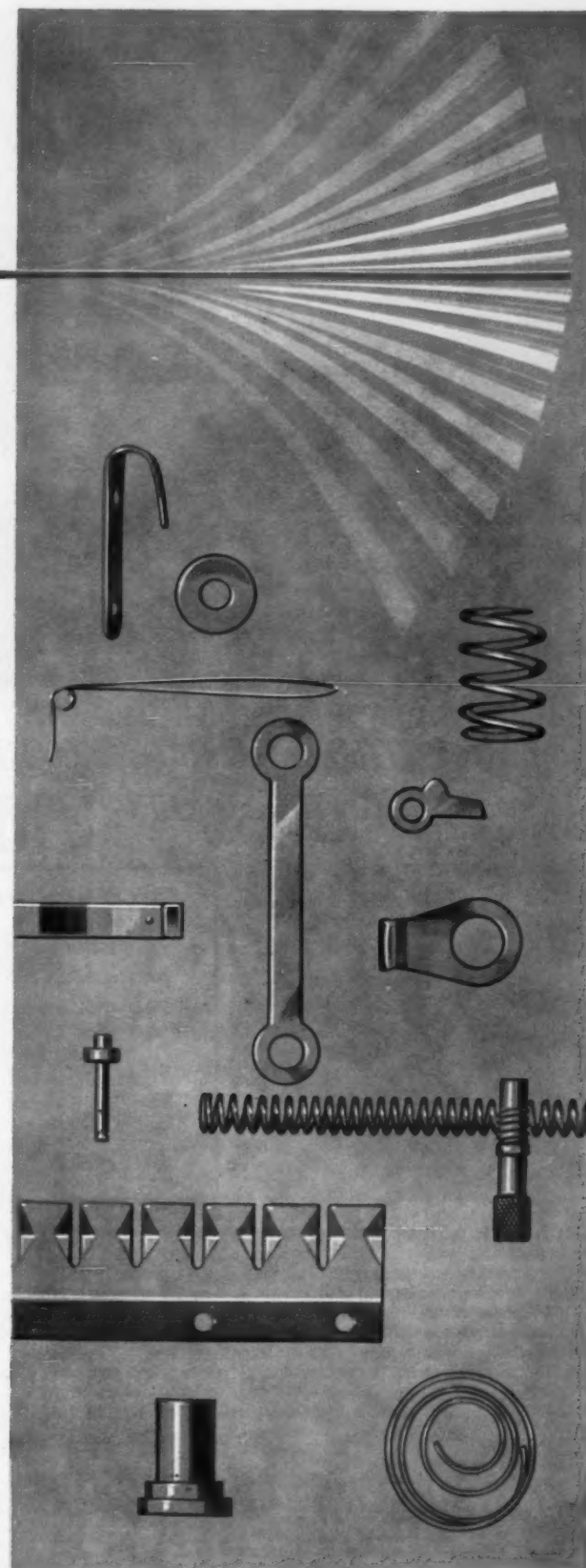
Publication B-38 tells the story. Write for your copy—or for any assistance from our Metallurgical Dept. in selecting the proper alloys for your design problems. Address: Anaconda American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 61-2109

## DURAFLEX®

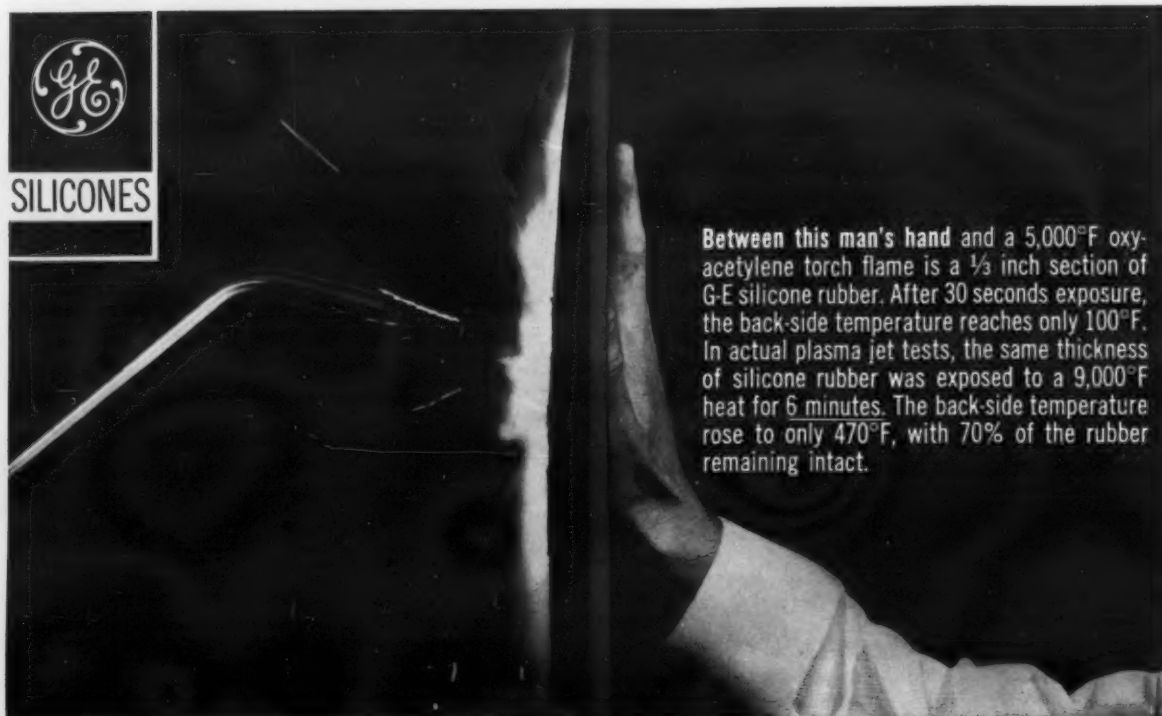
A product of

## ANACONDA®

AMERICAN BRASS COMPANY



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Between this man's hand and a 5,000°F oxy-acetylene torch flame is a 1/8 inch section of G-E silicone rubber. After 30 seconds exposure, the back-side temperature reaches only 100°F. In actual plasma jet tests, the same thickness of silicone rubber was exposed to a 9,000°F heat for 6 minutes. The back-side temperature rose to only 470°F, with 70% of the rubber remaining intact.

## Thermal barrier against 5000°F flame

### GENERAL ELECTRIC SILICONE RUBBER



The surface of the tested rubber section forms a hard, carbonaceous crust, while the underside remains flexible and undamaged. Preliminary tests showed the effective heat of ablation to be eight times better than presently used plastics, with one-seventh the rate of ablation and one-fourth the weight loss. Here is an excellent ablative covering with low thermal conductivity.

#### RESULTS OF PLASMA JET TESTS AT 9,000°F

Flight Simulation  
Vel. = 17,000 ft./sec.  
Alt. = 250,000 ft.

Exposure time at 9,000°F	Back-side temperature of 1/8 inch section of G-E silicone rubber
30 seconds	100°F
2 minutes	210°F
3 minutes	300°F
4 minutes	375°F
5 minutes	430°F
6 minutes	470°F

The above chart shows how the high thermal insulation of G-E silicone rubber is maintained during exposure to 9,000°F heat. It is also useful in mechanical and electrical applications at temperatures from -150°F to 600°F, where it remains resilient and flexible. It also maintains its excellent physical and electrical properties over this wide temperature range for extended periods.

Continued high temperature testing goes on at General Electric's Missile and Space Vehicle Department in Philadelphia. Shown above is a typical specimen undergoing plasma jet testing in an electric arc heated supersonic wind tunnel. Continuous testing like this will develop new data on the thermal and ablative uses of G-E silicone rubber.

To learn more about G-E silicone rubber, and its uses as a thermal and ablative material, write: General Electric Company, Silicone Products Dept., Section D1161, Waterford, New York.

# GENERAL ELECTRIC

Circle 45 on Reader-Service Card for more information

## IDEAS... ELECTRICAL

### Encapsulated Armature Improves Cordless Drill Efficiency

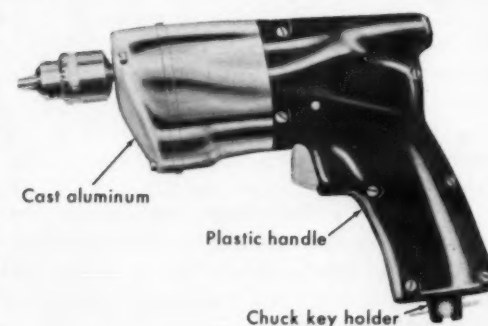
Victor W. Wigotsky, Eastern Editor

A fiber-glass potting compound encapsulates the armature assembly of a new cordless electric drill. Elimination of rotating iron reduces inertia and eddy current losses.

Increased electrical and mechanical efficiency was a major objective in order to better utilize the output of the drill's four nickel-cadmium power cells. Electrically, it was important to reduce the iron losses and inertia of the motor. Instead of using a conventional wire and laminated iron armature, the windings and commutator now are assembled first and placed in an encapsulating mold. At the same time, the armature itself is molded to a steel shaft. The result is a lighter, more efficient motor. In addition, silver contacts and silver-impregnated brushes reduce electrical resistivity and permit more efficient use of the unit's power cells.

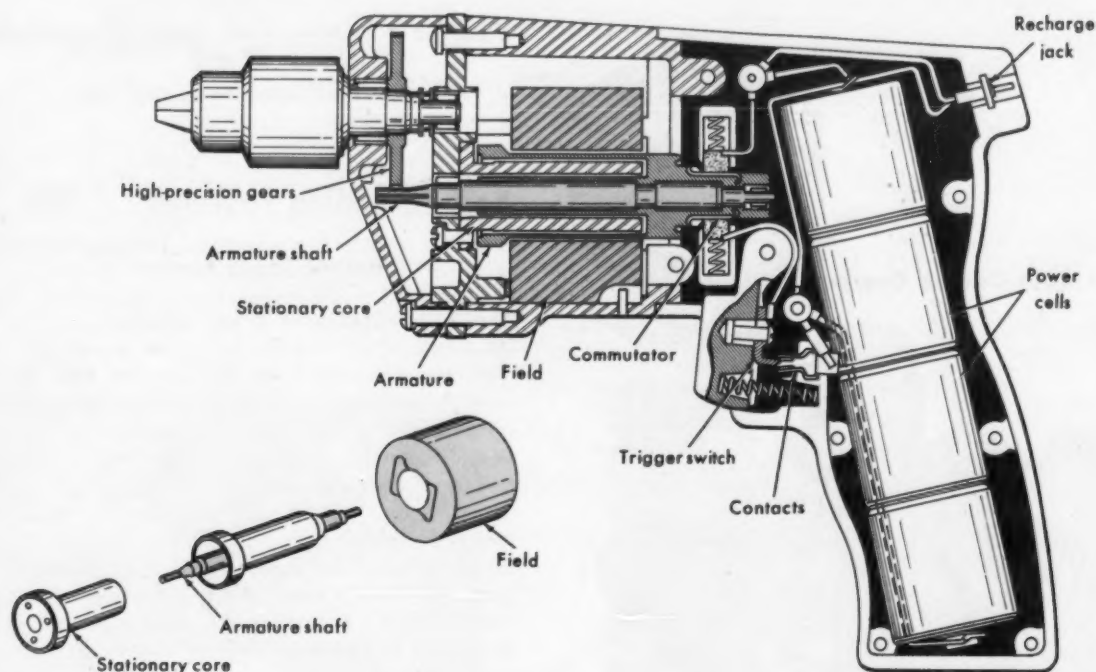
The drill's mechanical efficiency is increased with an extra-fine pitch, single gear reduction. Normally, considering the drill's high gear ratio, a double reduction or worm drive would be used. The single reduction minimizes misalignment and reduces frictional losses. Low-friction needle bearings also are used for this purpose.

The 1/4-inch cordless electric drill was designed by The Black and Decker Mfg. Co., Towson, Md.



**PORTABLE SELF-CONTAINED DRILL** is independent of conventional power connection. Power cells can be recharged at least 400 times before replacement. Charger, purchased with unit, connects to conventional 115v power line and consists of transformer, rectifier and two resistors. One resistor is used for normal charge (16 hr) and other for special quick charge (5 hr). Drill is shockproof and has no-load chuck speed of 800 rpm. Total weight, including four power cells, is 4 lb.





ARMATURE'S MAGNETIC PATH is supplied by inner stationary core. Path runs from stationary field, through wires molded in fiber glass, then through core, armature shaft, other wall of armature and back through field. Potting compound encapsulates wire and supports commutator, all of

which are molded to steel shaft. Ball-thrust bearing is mounted on chuck spindle. Extra-fine 80-pitch, single-reduction gearing contains eight-tooth pinion and 129-tooth gear. Instant-release trigger switch contains safety latch, similar to automatic pistol.

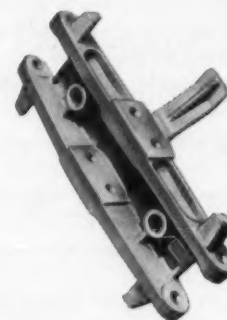


*Senzfo mask from the African Ivory Coast, cast in bronze. Courtesy of The Museum of Primitive Art, New York City.*

## an ancient art cuts costs for MODERN INDUSTRY!

In man's conquest of metal, one of the great technical advances was the ancient art of "lost wax" casting. That art, today known as "investment casting", has become a precision technique that is cutting costs for modern industry. It is the most economical method for casting intricate precision parts and sub-assemblies in most ferrous and non-ferrous alloys.

We would welcome the opportunity of having our representative call on you . . . and we invite you to submit prints for an estimate.



### 55% saved!

The intricate Bracket shown here, investment cast in steel to close tolerances, has inherent structural strength with minimum weight. Production costs were more than halved!

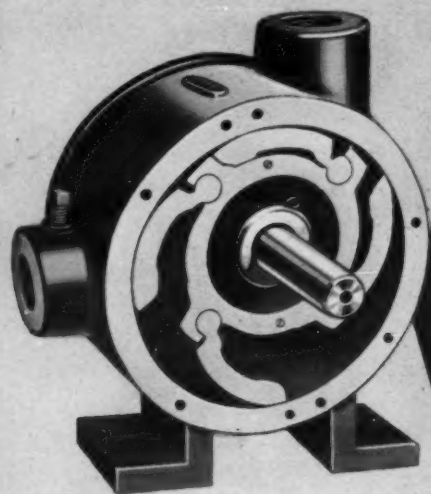
## INVESTMENT CASTING CO.

Subsidiary of Faradyne Electronics Corp.  
60-C Brown Avenue, Springfield, N. J.



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## The BIGGEST SCOOP in AIR PUMPS!



**LEIMAN**  
**CURVED VANES**  
**SCOOP UP MORE AIR**  
- provide high capacity  
with slower speeds and  
less wear

Four curved vanes scoop up large volumes of air—provide 2 to 3 times more air space. Mounted on easy-action hinges to assure perfect contact with cylinder walls by centrifugal force. Vanes and cylinders made of durable cast iron (no composition). Hone themselves to hard, glassy smoothness to assure leak-proof seal and reduce frictional wear. Negligible wear is automatically taken up by rotating vanes.

Leiman Air Pumps maintain new-pump efficiency and fully-rated vacuum or pressure for the life of your equipment, with little or no maintenance or repair. Fewer moving parts—no gaskets or packing—no composition vanes to wear out or renew. Pulseless airflow—every pump tested. Many models and sizes to meet your needs. Over 70 years' air engineering at your service on any design or application.

LEIMAN BROS., INC., 156 Christie St., Newark 5, N. J.

Established 1889



Write for new catalog showing construction, types, sizes and specifications, plus Application Book containing many "how-to-do-it" blueprints.

**LEIMAN** Rotary Positive  
**AIR PUMPS**

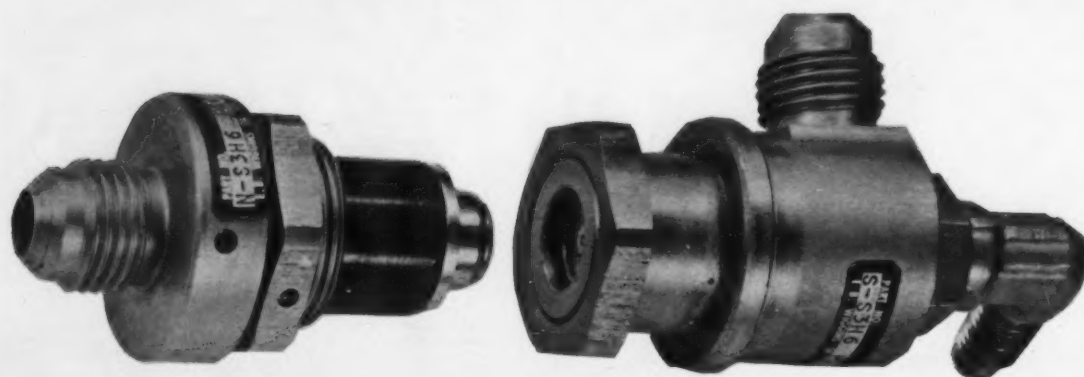
Vacuum to 29.9" Hg. Pressure to 20 p.s.i.g. Volume to 162 c.f.m.

Circle 46 on Reader-Service Card for more information



## Nonlatching Coolant Connector

**Drawer-Mounted Connector for Liquid-Cooled Components**



Liquid-cooled components may be drawer-mounted by use of this miniature fluid connector. The non-latching connector was designed for minimum fluid spillage and air-inclusion capabilities. Operating pressures of 60 psi, 300 psi proof and 600 psi burst over operating temperatures from  $-65$  to  $250^{\circ}\text{F}$  add to the

connector's versatility. The 90-deg elbow at the rear of the A-S3H6 fluid connector may be rotated to any position after assembly.

Wiggins Oil Tool Co., 3424 E. Olympic Blvd., Los Angeles 23, Calif.

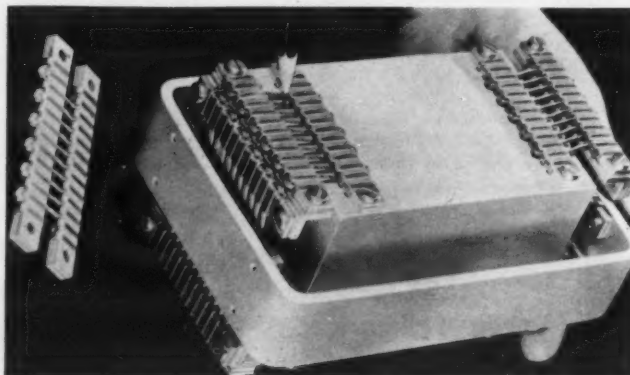
## Twisted Cable Shock Mount

**Prestressed Cable Provides Shock Isolation System**

Prestressed strands of twisted cable mounted between two steel retainers furnish the support in this shock and vibration isolation system. The system is said to furnish protection of a supported mass in any attitude from shock and vibration or random noise, even though combined with a heavy G load. The device is said to never bottom even when severely overloaded. By using L-type brackets, individual isolators can be joined to form a complete isolating system for larger pieces of equipment. The cable isolator provides antiresonance features and is adjustable in the field for optimum detuning. Because of their small size, cable isolators are attractive for shipping containers or custom-engineered mountings. For conventional specifications, a clearance of 0.25 inch will suffice for cable-isolated equipment and will be adequate with as much as a 5G steady-acceleration load. The isolators require no "snubbers" or motion limiters needed for other types of isolators. The device is

unaffected by temperatures from  $-100$  to  $500^{\circ}\text{F}$ , meets MIL-E-5272C and exceeds requirements of MIL-C-172.

Aeroflex Laboratories, Inc., Cable Isolator Systems, 48-25 36th St., Long Island City 1, N.Y.

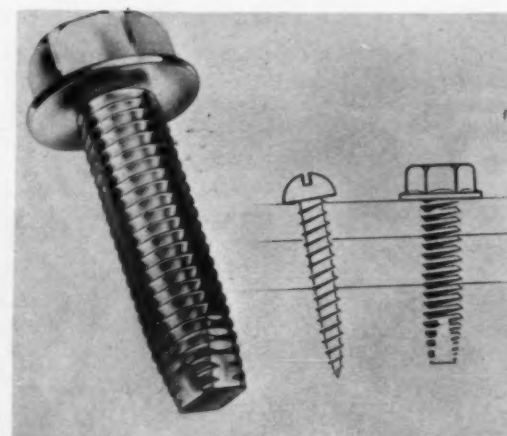


## 301 Self-Threading Fastener 303

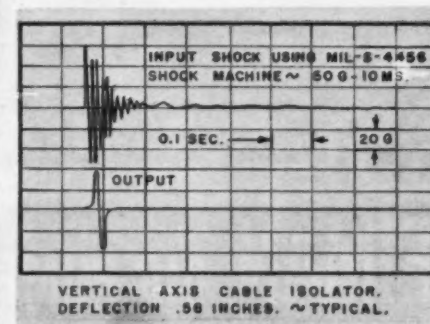
**Drives More Easily**

The square-sided point of this fastener is said to allow it to be driven more easily and straight into the material being fastened. The Type "S" fastener uses the same diameter lead holes as corresponding self-threading screws, making changes in present equipment set-up unnecessary. The lower driving torque makes the unit less likely to strip and reduces the possibility of head breakage. The thread forming screw also is said to leave no chips or ribbons which could interfere with electrical contacts. The straight sides of this fastener maintain constant friction with the mating parts, which helps to prevent loosening by vibration. Expected applications include automotive fields, appliances, TV and radio, vending machines, air conditioners, office and store equipment.

National Lock Co., 1902 Seventh St., Rockford, Ill.



## 302

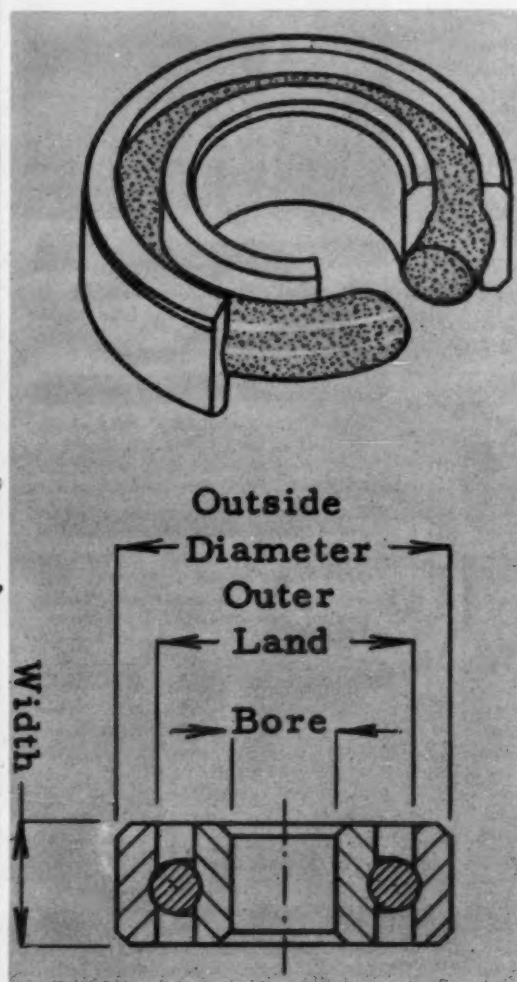


## O-Ring Bearing

304

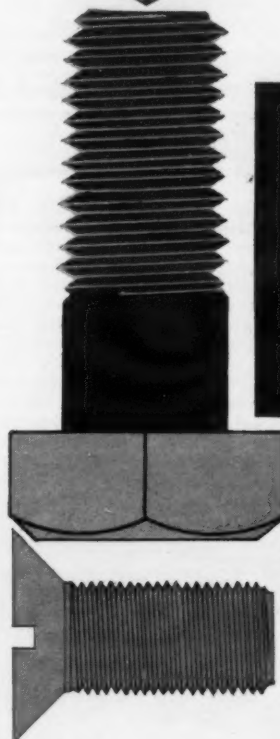
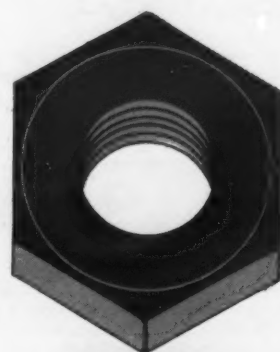
### For Vacuum Applications

Sliding takes place between the O-ring and the races of this bearing. Requiring no lubrication or maintenance, glass-filled "Teflon" or other low-friction materials are used for the O-ring, while the races are made of stainless steel. Designed for corrosive or highly contaminated environments, the bearings are readily adaptable to oscillatory



applications. The bearings are shock-resistant, extremely quiet and well suited to use in vacuum systems. OD's of the bearings range from 0.1562 to 0.6250 inch; bores range from 0.0469 to 0.2500.

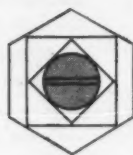
Federal-Mogul-Bower Bearings, Inc., Microtech Div., 1201 N. Arden Dr., El Monte, Calif.



# imagin- eering

There's a bold, new look at Screw & Bolt. To the industrial designer, this new look means infinite design capability. Thousands of samples of specials we have made attest to our ability to make most any fastener you can design. Screw & Bolt's **Imagineering** is at your disposal, too! ■ Send for our booklet "Imagineering," and when you need threaded fasteners or parts, think of Screw & Bolt!

VMA 9559 D



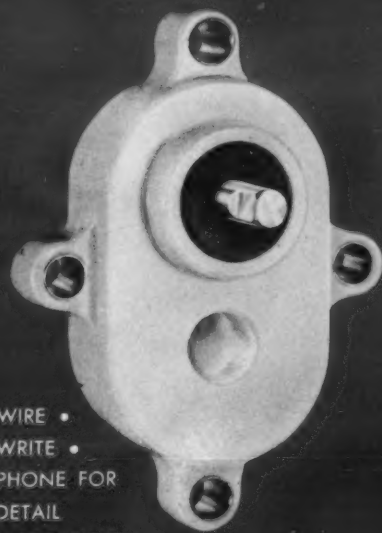
**SCREW AND BOLT CORPORATION**

OF AMERICA • P.O. BOX 1708, PITTSBURGH 38, PA.

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**Imagineering . . . for greater fastener progress**

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Chicago 46, Illinois  
INdependence 3-0232

THE PUMP ON THE COVER OF DESIGN NEWS

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## Don't let these Devils INTERFERE with OPERATING PERFORMANCE



Troublesome maintenance and lubricating problems are eliminated when you specify Thomas "All-Metal" Flexible Couplings to protect your equipment and extend the life of your machines.

Like a thief in the night an inadequate coupling causes wear and damage to your machines—resulting in high maintenance costs and costly shut-downs.

UNDER LOAD and MISALIGNMENT only THOMAS FLEXIBLE COUPLINGS offer all these advantages:

- Freedom from Backlash
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- No Lubrication • No Wearing Parts
- No Maintenance



Write for Our New Engineering Catalog 60  
**THOMAS FLEXIBLE COUPLING COMPANY**  
WARREN, PENNSYLVANIA, U.S.A.

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## MECHANICAL

### Precision Metering Valve

305

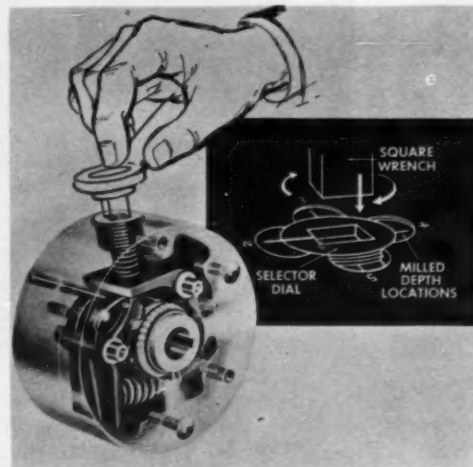


Flow rates from approximately 0.01 standard cc per sec to 5 cc per sec are obtainable with this precision metering valve. The "Vari-Vac" is used to adjust pressure in vacuum vessels from a low of  $10^{-7}$  mm of mercury to 1 atmosphere. The device is available in nickel-plated brass or stainless steel with a choice of quick-connect or sweat fittings.

Vactronic Lab. Equipment, Inc., East Northport, N.Y.

### Overload Release Clutch

306

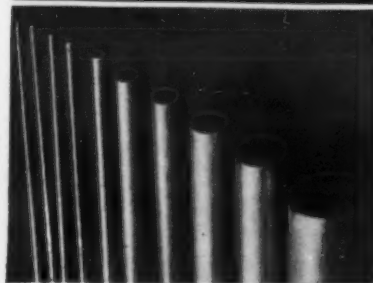


Protection of motors and machinery is provided by this release clutch which disengages upon overload. The clutch includes a torque selector dial which may be set for different load requirements. An additional safety factor is provided by an indicated maximum torque limit which protects against clutch lockout. In the event of an overload, a sensitive trigger action immediately disconnects the load from the driving unit. An actuating unit is available which will open an electrical circuit at the same moment the load disconnects from the drive unit. It may operate brakes, lights and alarm systems.

Centric Clutch Co., Box 175, Woodbridge, N.J.

## quick source for fine Seamless Tubing in

### NICKEL ALLOYS



#### NICKEL

"A" nickel, 220, etc. Excellent cathode emission, high strength and rigidity at elevated temperatures for electronic and instrument applications.

#### MONEL

The all-purpose nickel alloy—non-corrosive, non-contaminating—in chemical processing, food, petroleum, marine, rocket motor applications.

#### INCONEL

Resistance to corrosion particularly recommends it for food, dairy and pharmaceutical applications; dental, surgical and industrial instruments; rocket and jet fuel lines, etc.

#### 30% CUPRO-NICKEL

Copper-based alloy widely used for fine wire connectors, prongs and electrical contact tips, electrical and medical instruments.

**Sizes:** from .005" O.D. to .375" O.D.  
**Wall Thicknesses:** from .035" to .0005".  
**Tolerances:** to  $\pm 0.00005$ ".

**Delivery:** Normally 3 weeks for tubing, 4 weeks for fabrications.

**Fabricated Parts:** a complete service specializing in burr-free, close-tolerance cutting, bending and flaring.

Write for information on tubing or tubular parts, made from these alloys, as well as many other alloys of aluminum, copper, steel, the precious metals, glass-sealing and refractory alloys.



**UNIFORM TUBES, INC.** COLLEGEVILLE 2, PA.

HUxley 9-7276 TWX:CGVL 1044

Circle 51 on Reader-Service Card



## D-C Timing Motor

307

A permanent magnet enclosed by a nonferrous rotor cage and windings provides stabilizing eddy currents which minimize speed changes resulting from loading and temperature variations. The design also eliminates preestablished poles which cause cogging action usually found in d-c motors. Weighing only 6 oz, the motor uses long-wearing brushes, polished commutator segments which rotate at a low peripheral speed and vacuum-impregnated rotor bearings to furnish a long, trouble-free life. The motor and its gear train are totally enclosed to provide protection from adverse environments. Vibration- and shock-resistant, the 43100 Series motor is available with various types of gear trains and with windings for 6, 12 or 27-1/2v d-c, standard. The unit is offered with 150 different output speeds ranging from 2700 rpm to 1/2 rph.

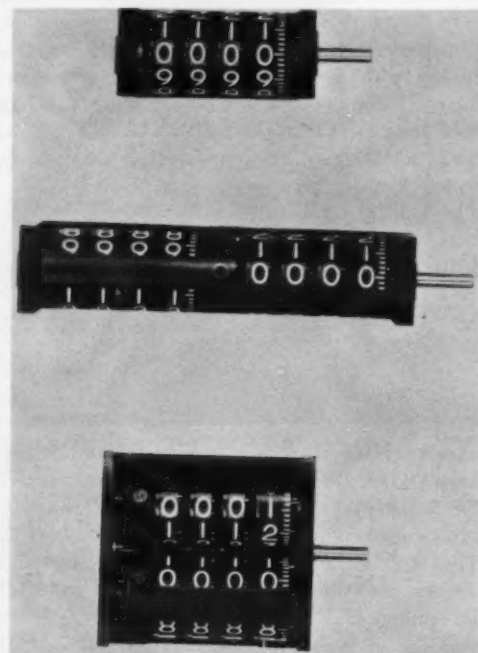
A. W. Haydon Co., Waterbury, Conn.

## High-Speed Mechanical Counters

308

Featuring low torque at high speed, these counters are constructed with a rigid, lightweight, single-pieced, aluminum-diecast frame. "Oilite" bearings provide permanent lubrication of the stainless-steel shaft while open-frame construction allows easy illumination. The counters can be furnished in a wide variety of numeral and background colors and with special features including cursor lines, decimal points and double-shaft extensions.

Veeder-Root, Inc., 70 Sargeant St., Hartford 2, Conn.



# Some Ideas

Frankly, we hope you're a fusspot. If you are fussy about the way you work, and proud of it, we think you'll enjoy knowing about three K&E items which reduce the effort required to get pin-neat results. Our first suggestion is...

### A Better "Mattress" for Your Drawing Board

Drawing on a plain wooden board surface goes against the grain of most of the draftsmen we know. They feel—and we concur—that the best results are obtained on a smooth even surface, one that's firm yet resilient. And the covering should also be easily cleaned.

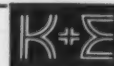
We offer, in evidence of our desire to please, two excellent board coverings: PARAMOUNT® 72 Board Covering. This is our finest board surface material—a heavy duty vinyl with some remarkable properties. Its surface is so springy that you can bear down with hard pencils, and yet minutes later see no line depressions. Even pinholes from a compass close up rapidly. The surface is in a soft, eye-ease green, making it glare-resistant even under fluorescent lighting. You'll find PARAMOUNT is simple to mount, and once it's on, it stays.

LAMINENE® N70 Board Surface Material is a less permanent covering but has many



excellent features to recommend it. As the name implies, this is a hard vinyl covering laminated to a firm paper base. It has several practical advantages over plastic coated papers. You can stretch it, drum-head tight, over your board. Simply wet the back, secure the edges by taping or stapling. After drying, LAMINENE grips the board as if cemented. This product is available in white or eye-ease green, plain or with grids.

Free samples of both coverings are yours for the asking.



for your file of practical information on drafting and reproduction from

KEUFFEL & ESSER CO.

### Stickers With Delayed Action

Want to eliminate a time-consuming chore? You can cut down on tedious repetitive lettering by having title blocks, specifications, and other symbols or legends printed—clearly and sharply—on DULSEAL™. (74). This tissue-thin film has a delayed-action adhesive on the back, and a dull-finish face for easy writing or printing.



Stickers made of DULSEAL can be firmly positioned—and re-positioned hours later, just as firmly. The adhesive takes 24 hours to set. Once it does set, a permanent bond is formed with the paper or cloth beneath. DULSEAL is chemically stable, and the adhesive will not bleed, even in hot copying machines.

Repeated erasures on DULSEAL will not affect its "take." Produced by an exclusive

process, the "tooth" is built into the surface. Transparent and low in reflectivity, DULSEAL stickers will not affect the transparency or printing speed of your drafting medium. K&E supplies DULSEAL in sheets, rolls (printed to your specifications if you wish), and as a mending tape in a handy dispenser. Try a sample, on us!

### 3 To Keep Clean

Best way to keep your tracings clean: don't let them get dirty. A mighty easy way to achieve this is to sprinkle the tracing lightly with gum eraser particles, while working. Then, triangles, T-squares, and scales stay clean, and clean the surface automatically, as they are moved back and forth. The particles will not dry out or harden—they contain no grit or abrasives. They'll actually improve the ink taking qualities of your drafting surface.



For this purpose, K&E supplies cleaning particles put up in three different ways. We think the new plastic squeeze-bottle (3036C) is the handiest of all. The shaker-top can (3036) has also been a drafting-room favorite for some time. And, for double-duty cleaning, we suggest the ABC Dry-Clean Pad™. (3037), which holds slightly coarser granules that sift through soft mesh. The ABC Pad also comes in handy for wiping a complete tracing after it is finished, or for preparing certain surfaces for ink work. Or for an overall pre-cleaning, since the best way to insure clean tracings is never to let soil build up.

The proverbial ounce of prevention is worth the traditional pound of cure!

These K&E products, and others that can make life easier for you, are available from your nearby K&E dealer. See him soon... or send us the coupon below for further information and samples.

KEUFFEL & ESSER CO., Dept. DN-11 Hoboken, N. J.

Please send me samples and information on LAMINENE® and PARAMOUNT® Drawing Board Surface Material, and DULSEAL™. Tape... plus information on K&E cleaning powders.

Name & Title \_\_\_\_\_

Company & Address \_\_\_\_\_

4289

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## NEW BRISTOL SERIES 6100 TIME DELAY RELAY



## 7 TYPES OF LOAD CIRCUIT OPERATION ALL IN A SINGLE UNIT


Bristol's new Series 6100 gives you easy application with exclusive flexibility. No more complex wiring changes! Make circuit changes in a jiffy, too. You can reach the motor, and other parts—in seconds. The new "Bristol-Vision" dial is mounted in a square die-cast frame—provides better contrast for better viewing plus functional beauty too. Non-scratch bevelled glass dial cover won't buckle, deform—seals against dust. Powered by famous duty-matched standard Bristol motor. Write for brochure.

Contact the Bristol Distributor or Representative in your area.

**SEND FOR HANDY TIMING  
CONTROL PRODUCT DIGEST**  
—complete range of Bristol  
Motors, Timers and Timing De-  
vices for all your timing and  
control applications.



**LEADING SPECIALISTS IN  
AC AND DC MOTORS**  
—from standard to  
special configura-  
tions designed to your  
specifications.

**BRISTOL  MOTORS** Division of Vocaline Company of America, Inc. / Old Saybrook, Conn.

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## MECHANICAL

### Hydraulic Checking Cylinder 309

Designed to work with any suitable air cylinder, the Series S smooths out stroke-speed variations and provides dial-set speed control at any desired speed from 3 to 300 inches per minute. Capacity is 1000 lb maximum on the "out" stroke—the return stroke is free. Models are available in standard

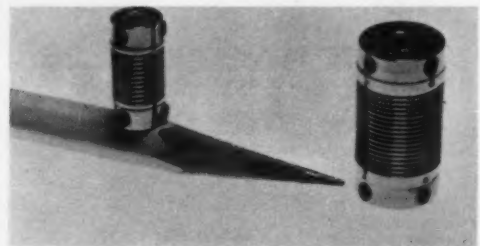


checking-stroke lengths through 18 inches or longer on special order. The checking cylinders have a chrome-plated steel piston rod with wrench flats, builtin rod wipers and an easily refillable oil reservoir with visual "low" signal built in.

Modernair Corp., 400 Preda St., San Leandro, Calif.

### Flexible Shaft Coupling Without Backlash 310

A metallic bellows serves as the flexible element in this miniature shaft coupling reported to operate without cyclic angular displacement or backlash during rotation. Superior flexibility and endurance result from the use of corrosion-resistant nickel for the bellows flex element. The couplers are offered in two standard sizes: No. 1-MB, 0.700-inch long by 0.312-inch bellows OD for 3/32- to 5/32-inch shafts and designed for 0.6 lb-in torque;



and No. 2-MB, 1.00-inch long by 0.500-inch bellows OD for 1/8- to 5/16-inch shafts and designed for 2.0 lb-in torque. Nonstandard bellows couplings are available on special order to 250 oz-in. They are used for shaft couplings in tuners, transducers, precision indicators, computers and similar equipment.

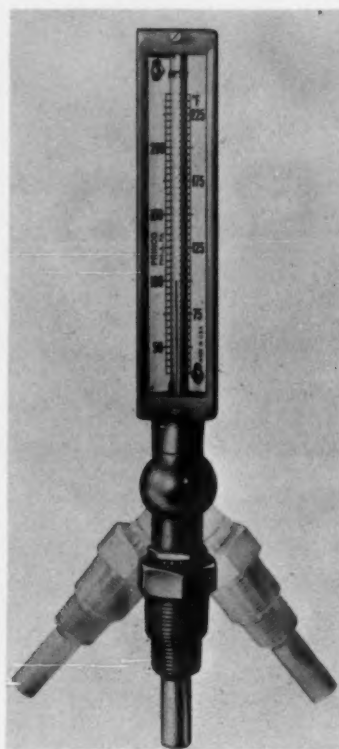
Guardian Industries, Inc., Coupling Div., 1215 E. Second St., Michigan City, Ind.



## Thermometer

311

Piping and other obstructions may be by-passed easily with this six-inch "MultiForm" thermometer. Positive locking at the selected position is assured by internal tapered-lock construction with set-screw adjustment. These smaller thermometers eliminate the need for costly special orders. Available



in ranges from -40 to 500F, the device has a cast-aluminum case with a corrosion-resistant baked finish. All models have a red column and white face with black markings to assure easy reading.

Precision Thermometer & Instrument Co., 1434 Brandywine St., Philadelphia 30, Pa.

Circle 54 on Reader-Service Card



## solve the processing puzzle with EASTERN CENTRIFUGAL PUMPS

For your laboratory or pilot production line consider Eastern midjet centrifugal pumps and stirrers — and Eastern portable, top-, side-entering mixers (Bulletin 530). Chances are, the one unit you need is in one of these useful brochures. Write for them now!

In every detail of size, weight, space requirements, materials, power and costs, Eastern Centrifugal Pumps are made to match strict process requirements.

- **PRESSURES:** to 21 psi in single stage pumps; to 70 psi in multi-stage types
- **FLows:** capacities to 70 gpm in single-stage pumps, to 10 gpm for many multi-stage models
- **MOTORS:** standard motors for 115/230-volts 60 cycles 1 phase (other electrical characteristics available). Power range from 1/8 to 1 1/2 H.P.
- **ENCLOSURES:** drip-proof, totally enclosed, and explosion-proof ball-bearing frames
- **DRIVES:** all models available in belt or coupling drive with ball-bearing equipped stands. Space-saving close-coupled pumps most rugged and popular — but many pedestal models also available
- **SEALS:** a variety of rotary seals and stuffing boxes, to fit every application
- **METALS:** your option of cast iron, bronze, stainless steel (18-8 type 303 and 316) Monel, Cast Iron, Hastelloy "C"
- **INSTALLATIONS:** a wide range of transfer, recirculation, feed, boost, and filter-pumping applications

**TO FIND OUT:** write for the brand-new Centrifugal Pump Catalog — Bulletin 130. Here are all the models — including useful engineering data.

For a complete review of positive displacement pumps for non-lubricating fluids, write for Bulletin 220. Eastern Bulletin 400 is your guide to a broad line of midjet-centrifugal pumps and stirrers for the laboratory.

See the big Eastern pump — and mixer line at the Chem. Show: booth 1275.



## EASTERN INDUSTRIES, INCORPORATED

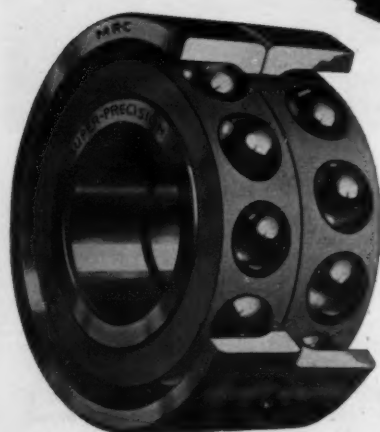
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Other Eastern products: • hydraulic motors • gear pumps • positive displacement pumps • aircraft pumps





# MARLIN-ROCKWELL MRC COUNTS in LANDIS 14" LR universal grinders



MRC pioneered, developed and produces Super-Precision Ball Bearings for high speed and to provide the ultimate in accuracy and load carrying capacity.

MRC Super-Precision Ball Bearings contribute to the reliability and accuracy of the all new Landis 14" LR Universal Grinders.

These bearings are used in the headstock and wheel feed — in this, the most accurate grinder ever produced by Landis Tool Company for medium production runs, as well as tool work.

BACKED BY 63 YEARS EXPERIENCE

Consult OUR Engineering Department on YOUR Bearing Problems



MARLIN-ROCKWELL CORPORATION

Executive Offices: Jamestown, N. Y.

Write directly to manufacturer on company letterhead  
for additional information.

## MECHANICAL

### Air-Driven Hopper Vibrator

312



A chrome-steel ball driven in an orbit on replaceable raceways is the only moving part in this compressed-air-driven vibrator. Small in size and weighing 7-1/2 oz, the unit will handle up to 10-cu-ft-capacity bins. It is used to bring powdered, particulate or crystalline materials out of hoppers, down chutes or through screens. The device will operate on as little as 5 psi and maximum air consumption is 6 cfm at 80 psi. The vibrator may be used safely in explosive atmospheres or in regions of high ambient temperature.

Martin Engineering Co., Neponset, Ill.

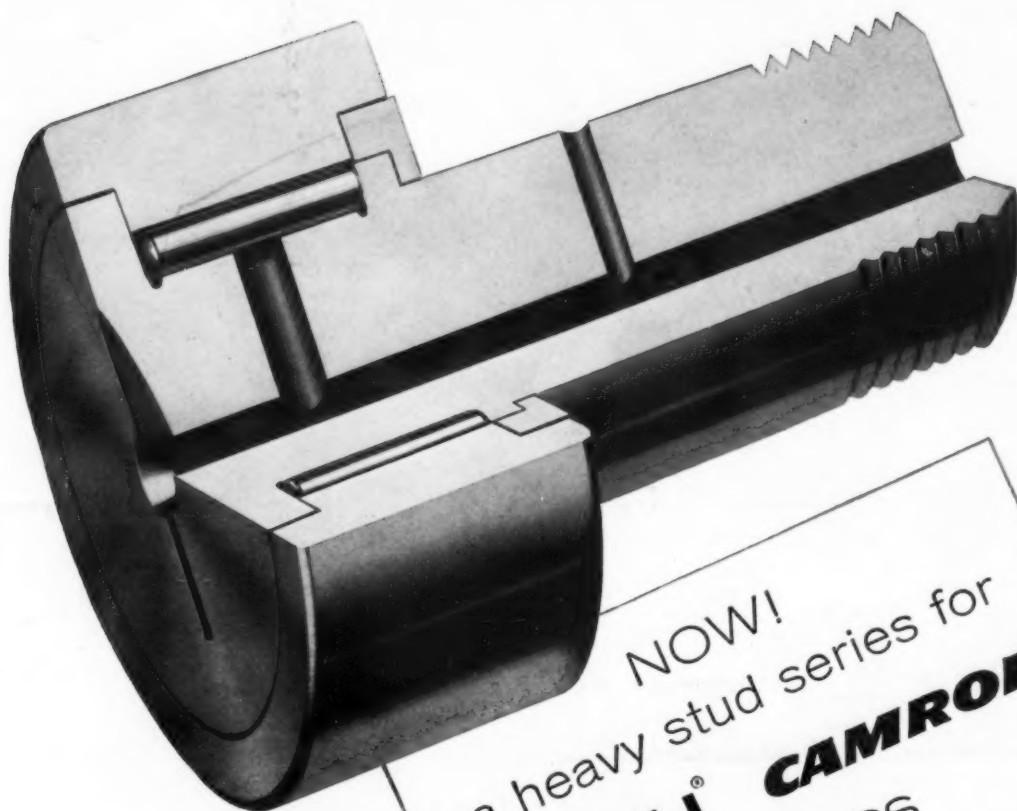
### Self-Aligning Flange Bearing

313

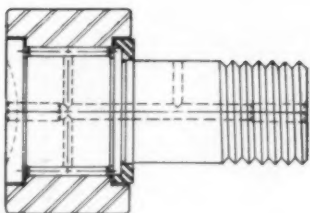


By using a housing having a spherical bore, these two-hole flange bearings align themselves with a shaft. The bearing is locked to a shaft ranging in size from 1/2 to 1-7/16 inches in dia by means of a self-locking eccentric collar. The collar mates with an eccentric cam on a wide inner ring of the bearing to provide a precision fit on the shaft. Bearings are factory lubricated and sealed for life. A rubber shield prevents the entry of foreign abrasive particles.

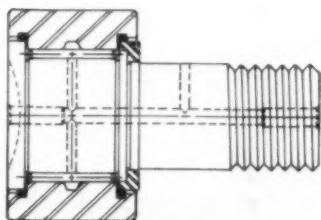
T. B. Wood's Sons Co., Chambersburg, Pa.



NOW!  
a heavy stud series for  
**McGILL® CAMROL®**  
BEARINGS



CFH SERIES



SCFH SERIES WITH  
INTEGRAL SEALS

#### with integral seals in a wide range of sizes

These CFH and sealed SCFH series units provide a heavy stud for otherwise dimensionally standard CAMROL bearings. These new McGill cam followers offer increased diameter studs that provide greater shear strength to accommodate excessive stud deflection in critically loaded track, guide, support and cam follower applications.

SCFH series heavy stud CAMROL bearings with integral seals for lubricant retention and protection against contamination are dimensionally interchangeable with the unsealed CFH series.

Both series available from stock in roller diameters from  $\frac{1}{4}$ " through 4"; larger sizes available on special order in production quantities.

*For information and data on the complete line of McGill heavy duty needle roller bearings send for Catalog No. 62.*



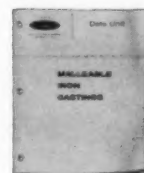
McGILL MANUFACTURING CO., INC.  
Bearing Division  
203 N. Lafayette St., Valparaiso, Ind.



Circle 55 on Reader-Service Card for more information

## Now—Finishes Add Beauty to Tough Malleable Castings

Beautiful, protective finishes on tough Malleable iron castings will give your products a superior combination of appearance, ruggedness, and economy. Get complete information on this sales-getting combination from any of the progressive companies that display this symbol —



**New Ideas** for your products are suggested in Data Unit No. 115, available free from any member of the Malleable Castings Council, or write to Malleable Castings Council, Union Commerce Building, Cleveland 14, Ohio.



The castings shown have been painted, blued, chromium and cadmium plated, plastic coated, porcelain enameled, galvanized, and machined.

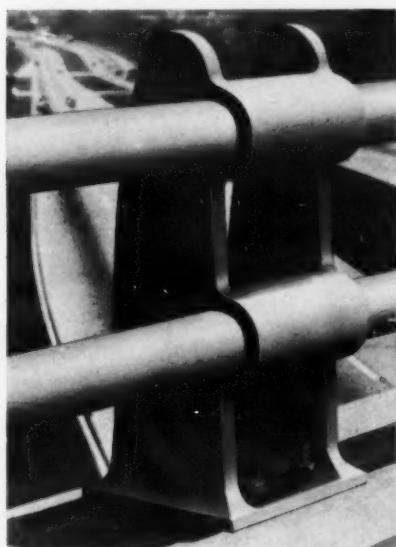


When appearance and long service life are important to your products, Malleable castings offer many advantages. Painting, hot dip galvanizing, blueing, and electroplating have long been used with Malleable castings because of their economy, attractiveness, and resistance to a variety of destructive conditions.

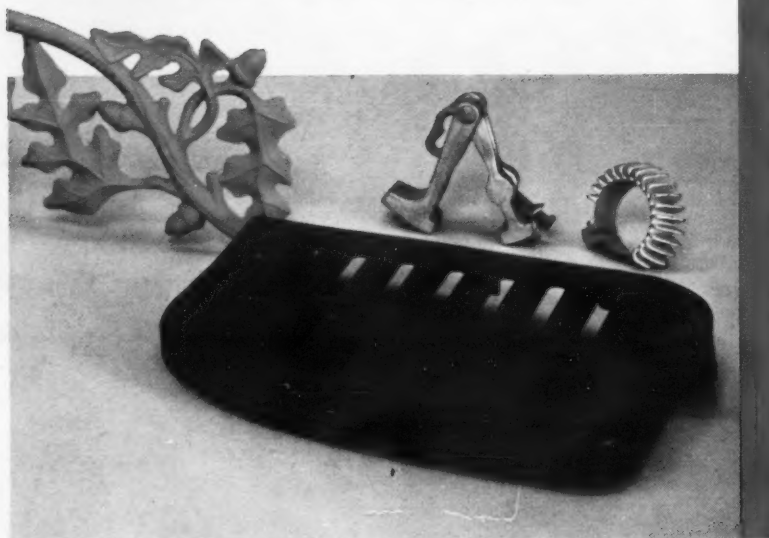
Several exciting new finishes appear very promising and are currently being tested by Malleable producers. Vinyl plastic in thin, contour-hugging films or thick, resilient coatings provide exceptional chemical resistance, and are available in a wide spectrum of strikingly beautiful colors.

Another attractive finish is porcelain enamel. In addition to smooth, gleaming surfaces in unlimited colors, it has excellent resistance to heat and chemicals.

The variety of finishes which can be successfully applied to Malleable gives designers outstanding opportunities to combine decorative and protective surfaces with the rugged dependability, economy, and versatility of Malleable castings. Call your Malleable supplier for information and quotations.



Bridge railing posts on the Connecticut Thruway are Malleable castings for three important reasons: (1) strong, ductile Malleable offers far greater resistance to fracture upon collision than other materials tried, (2) Malleable is easily galvanized for additional salt air corrosion resistance, and (3) with thousands of these posts in use, Malleable's economy produced real savings.



◆ Circle 56 on Reader-Service Card for more information ◆

## For Quality and Economy Use

MALLEABLE

### For Service Contact...

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**MASSACHUSETTS**  
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Cadillac Malleable Iron Co., Cadillac  
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**MINNESOTA**  
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The Eastern Co., Solvay  
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Central Fdry. Div., Gen. Motors, Defiance  
Dayton Malleable Iron Co., Ironton Div., Ironton  
Dayton Malleable Iron Co., Ohio Malleable Div., Columbus 16  
National Castings Co., Cleveland 6

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Lancaster Malleable Castings Co., Lancaster  
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Pennsylvania Malleable Iron Corp., Lancaster

**TEXAS**  
Texas Foundries, Inc., Lufkin  
**WEST VIRGINIA**  
West Virginia Malleable Iron Co., Point Pleasant

**WISCONSIN**  
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Chain Belt Company, Milwaukee 1  
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Milwaukee Malleable & Grey Iron Works, Milwaukee 46

These companies are members  
of the Malleable Castings Council

## Six-Speed Instrument Gearmotor 314



Here is a gearmotor with six positive repeatable speed ratios which can be changed easily while the motor is running. In standard models the ratios are 1:1, 2:1, 5:1, 10:1, 20:1 and 50:1. Built in a standard NEMA Size 25 frame, the gearhead can be adapted to any synchronous gearmotor from 600 to 1 rpm. The multispeed gearmotor can be used as a new instrument component, for prototype testing or in breadboards where the adjustable speed feature is necessary. Standard units are designed for 115v, 60 cycles, but special units are available.

InSCO Co., Div. of Barry Wright Corp., Main St., Groton, Mass.

## Normally Open Valve 315



Most solenoid valves are closed until the solenoid is energized. This solenoid valve operates in reverse - it is energized to close. Intended for use on many refrigeration applications, this valve makes reverse relays and long periods of "coil-on" operation unnecessary. Models are manufactured with either a-c or d-c waterproof epoxy-glass coils and with port sizes from 1/4 to 1-1/4 inches with either pipe or sweat fittings.

Jacks-Evans Mfg. Co., Controls Div., 4427 Geraldine Ave., St. Louis 15, Mo.

ROTARY AIR

**GAST**

PRODUCTS



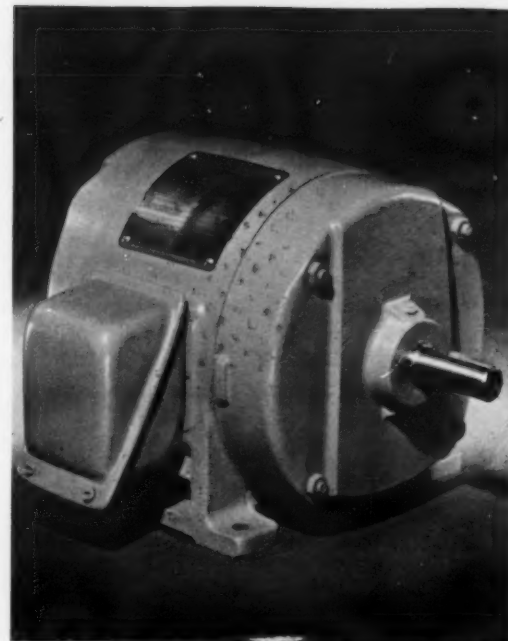
Model 2065 with motor,  
Gast base and coupling.

## MECHANICAL

### Synchronous Reluctance Motor

With efficiencies as high as 80 percent, these "Tri/Clad 55" synchronous reluctance motors are designed for applications where the load may not be constant, but where zero-slip, constant-speed operation is required. Constant-speed operation is achieved by grooving the rotor to establish the same number of lower reluctance paths as magnetic poles in the stator. These salient poles lock in step with the magnetic poles of the rotating stator field and cause the rotor to turn at synchronous speed. The Class A insulation system of these motors withstands effects of moisture, electrical stress and heat aging. The entire wound stator is dipped in clear, oil-modified, phenolic varnish, penetrating the stator slots and completely permeating the windings and core. Designed for use on synthetic-fiber manufacturing equipment, wrapping or folding machines, meshing conveyors or other industrial equipment where synchronous-speed drives are needed, these motors are available in both drip-proof and enclosed models. Ratings are 220/440v, three-phase, 60 cycles, from 1 to 5 hp.

General Electric Co., Schenectady 5, N. Y.



316

## Solve your product problems — specify positive displacement **GAST** **AIR COMPRESSORS**



Model  
0465



Model  
1065



Model  
2065

To enjoy excellent performance-per-pound . . . through years of demanding service . . . specify Gast heavy-duty Air Compressors. Forced-air dual fan cooling and automatic lubrication permit "round-the-clock" operation at rated pressures.

Design is simple and trouble-free. A rotor and four sliding vanes are the only moving parts. Vanes take up their own wear automatically to maintain "like new" efficiency for years. Air delivery is pulseless and positive in displacement. They're compact (no bulky tank needed) — and adaptable for direct coupling or V-belt drive. Supplied on base, coupled to motor if desired.

As original equipment or for plant service, they may help you solve design problems! May we send complete data?

Model No.	Rec. Max. Pressure, p.s.i.g.	C.f.m. @ 0 p.s.i.g.	Continuously	Intermittent	Motor h.p.	Net Wt.* Lbs.
0465	4.0	25	30	1/2	18	18
0765	5.9	10	15	1/2	18	18
1065	8.3	25	30	1	33	33
2065	17.0	15	20	1 1/2	52	52
2565	21.0	15	20	2	51	51
4565	45.0	15	20	5	92	92

\*Without base or electric motor.

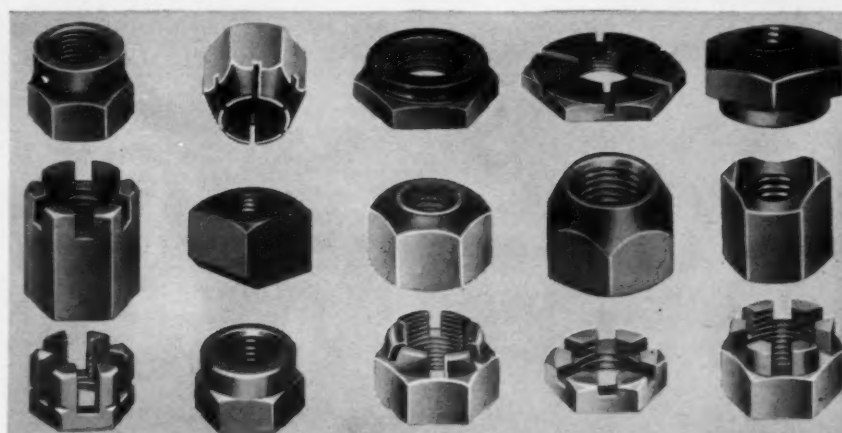
WRITE TODAY FOR BULLETIN P-HD.

GAST MANUFACTURING CORP., P.O. Box 117-G  
Benton Harbor, Michigan

**GAST**  
ROTARY

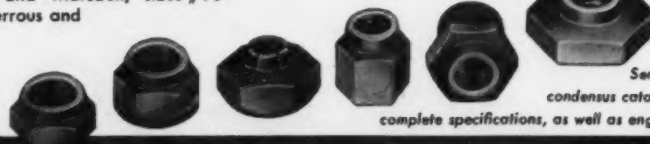
- AIR MOTORS TO 7 H.P.
- COMPRESSORS TO 30 P.S.I.
- VACUUM PUMPS TO 28 IN.

"Air may be your answer!"



Very often the special nut you require may be similar to one we are already making and a simple modification would result in a price advantage and quicker deliveries to you . . . in the field of locknuts we have made spectacular progress. Besides standardized hexagon "Conelok," "Huglock" and "Marsden," sizes #10 to 3" of ferrous and

non-ferrous materials, we provide many special application nuts, upon a basis of these designs . . . a few of which are shown (below) . . . our sales and engineering departments are available to help you solve your fastening problems.

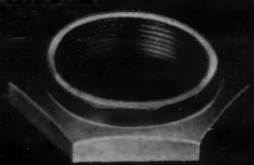


Send for 16-page  
condensu catalog, it includes  
complete specifications, as well as engineering data.

## SPECIALS

3/16" — 4 1/4" across flats

As the largest specialized nut manufacturer in the world we are constantly developing new methods and products for this phase of assembly in industry. Our batteries of special high speed multi-spindle, automatic machines make possible fast and accurate production of hexagon nuts of non-standard height and special shape from carbon or alloy steel, Naval Bronze or other non-ferrous metals, also AN310 through AN335 as per latest Airforce specifications.



**NATIONAL MACHINE PRODUCTS COMPANY**

an **sps** company 44250 UTICA ROAD UTICA, MICHIGAN

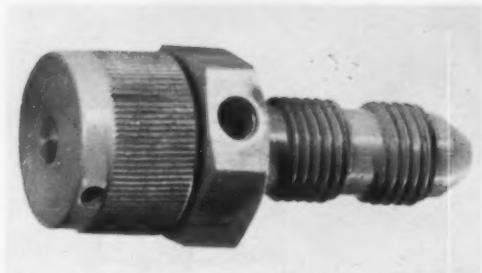
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### Bleeder Valve

317

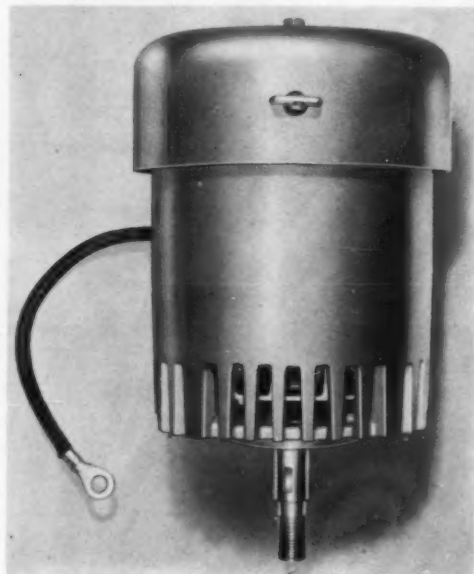


A positive-spring action automatically returns the knob to the closed position in this automatic bleeder valve. Designed for pressures to 5000 psi, the unit has a burst pressure of 25,000 psi. Operating over a temperature range of -65 to 275F, the valve is usable with water, fuel, air or normal industrial and aircraft oils. The unit's self-cleaning design prevents sediment clogging or contamination.

Greer Hydraulics, Inc., 5930 W. Jefferson Blvd., Los Angeles 16, Calif.

### Storage-Battery Motors

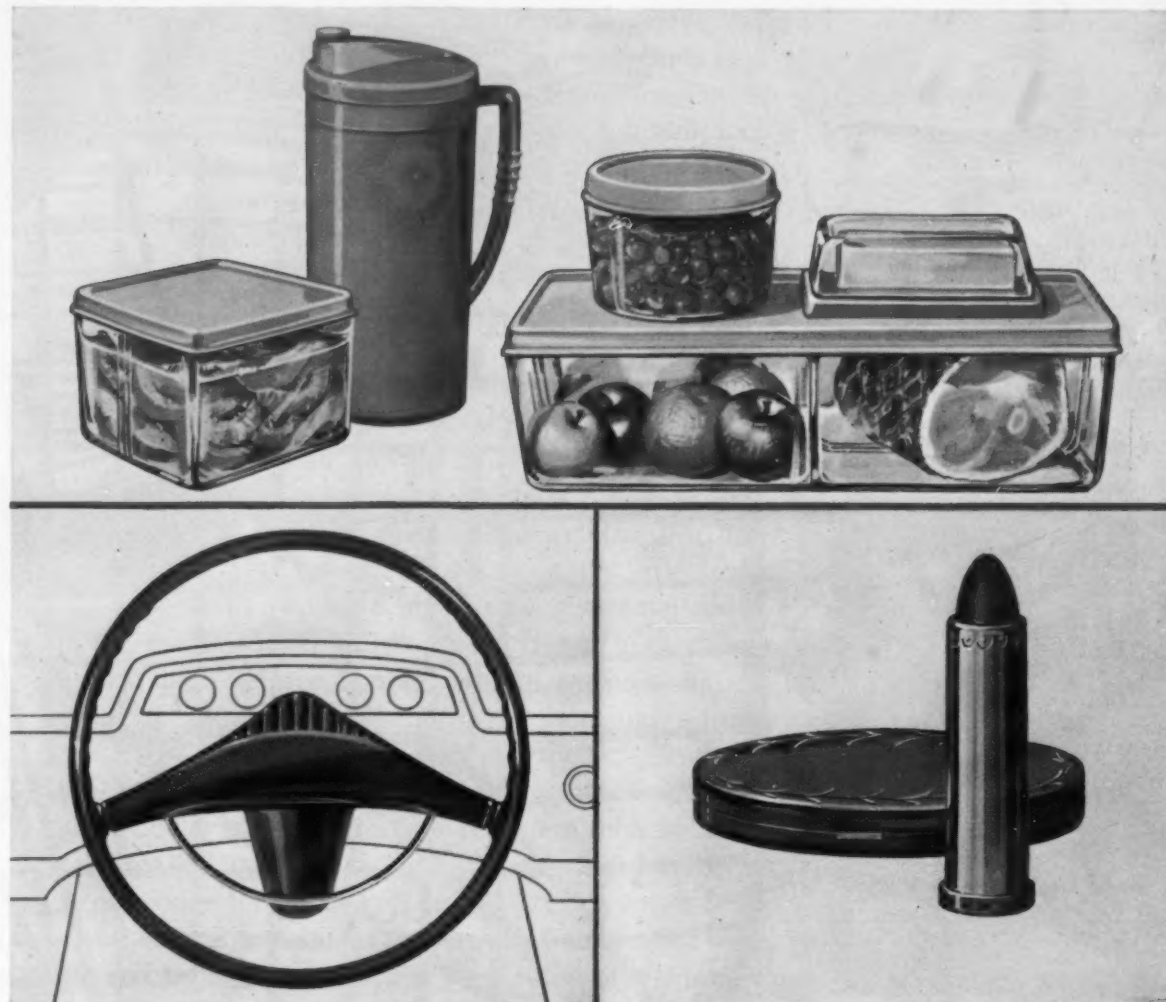
318



Weighing only 11-1/2 lb and developing 1/3 or 1/4 hp, these two new motors operate from 12v current. Motor output shaft diameters of 5/8 or 7/8 inch are available with shaft speeds of 2750 rpm standard. End-to-end ventilation assures proper cooling over the entire length of the motor, which operates at efficiencies in excess of 65 percent. The new motors are designed for OEM use in electric lawn mowers, golf-bag carts or other low-voltage battery-operated equipment.

Robbins & Myers, Inc., Small Motors Div., Springfield, Ohio.

## What's News in Plastics...



## Specify Escon<sup>®</sup> polypropylene for low odor pick-up

Escon has no taste or odor of its own and is highly resistant to stain and odor pick-up. This important property makes Escon an excellent choice for food storage containers and packaging, compacts and lipstick cases—even automobile steering wheels.

Escon polypropylene offers manufacturers a bal-

anced combination of properties for high-speed, profitable production—including resistance to dynamic fatigue, high strength, chemical and abrasion resistance, and many more. Expert technical assistance is always available. For full details, write to Enjay, 15 West 51st Street, New York 19, N. Y.

EXCITING NEW PRODUCTS THROUGH PETRO-CHEMISTRY

**ENJAY CHEMICAL COMPANY**

A DIVISION OF HUMBLE OIL & REFINING COMPANY

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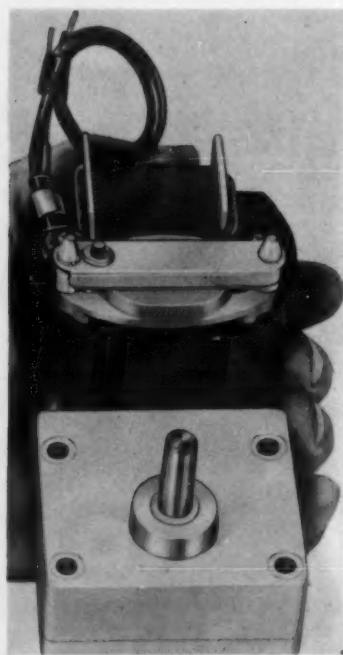




## MECHANICAL

### FHP Power Package 319

Able to develop up to 30 lb-in of torque in continuous duty, this power package is driven by a two-pole, unidirectional, shaded-pole, induction motor. Designed for the OEM market, the unit is offered with the drive shaft extending from either above or below, or from both sides, of the gear case. A variety of



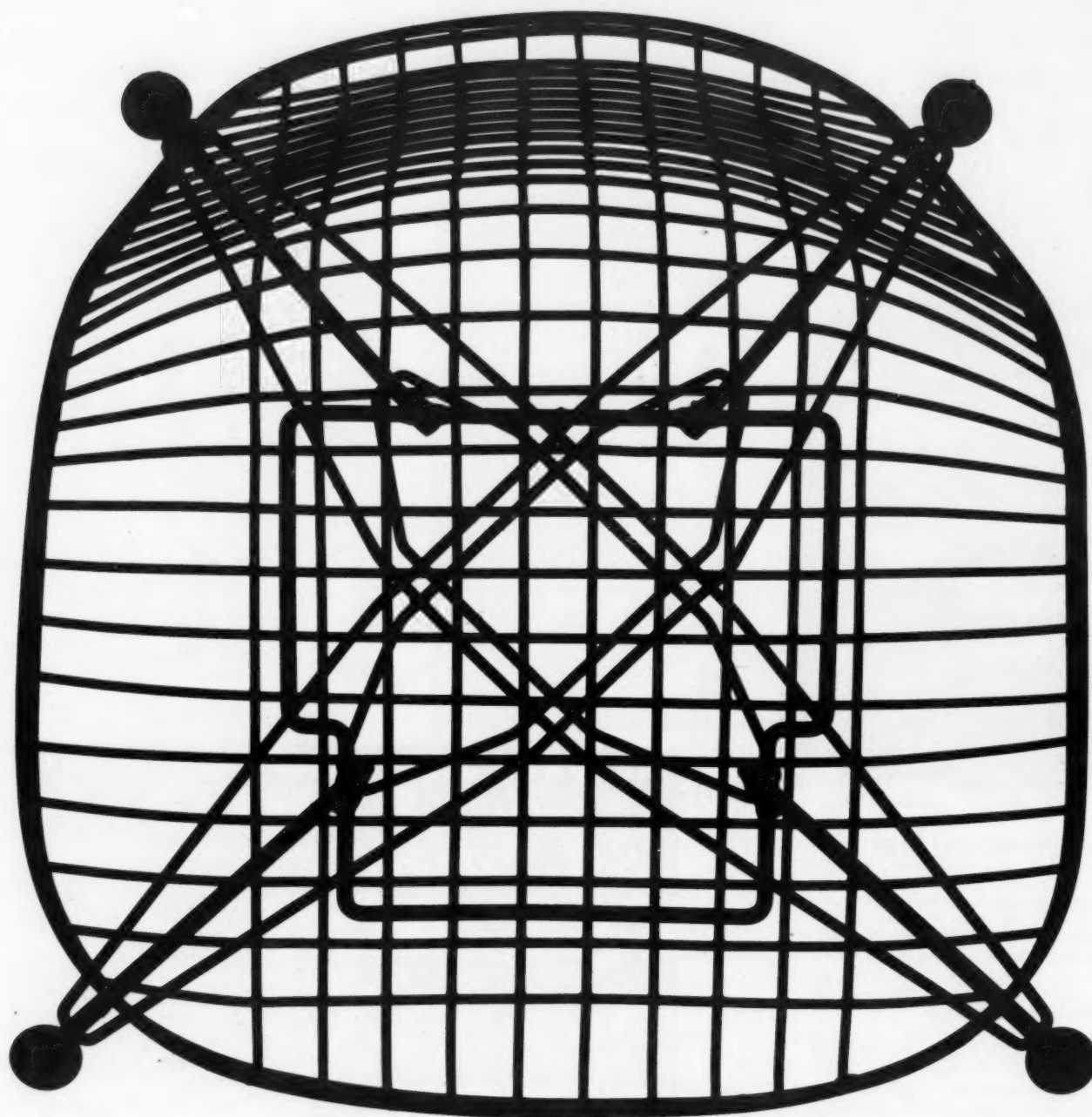
accessories is available, including brake, fan, special leads and thermal protectors. The power unit measures 2-21/32 by 2-11/32 by 4-15/16 inches. The standard motor operates on 115v, single-phase, 60 cycles a-c, although other motors are obtainable.

Merkle-Korff Gear Co., 213 N. Morgan St., Chicago 7, Ill.

## Get a new perspective on your product. Do it with steel wire!

Ten years ago, Charles Eames designed the steel wire chair shown here for Herman Miller Inc. In a serious exploration of the use of steel wire, Eames took this good and familiar material and used it in a unique new way for the home. By exploiting the facts that wire performs best in tension and lends itself to multiple welded connections, Eames developed this design in his continuing search for "minimum structure" for a chair. Today, after a decade of continuous production, the chair remains a design example for its exceptionally high weight-strength ratio as well as its comfort. ■ Wire is cold drawn through dies, and this cold reduction gives wire its great strength and smooth surface. It is available in a vast range of sizes, in hundreds of steel chemistries, just about any surface finish, and in strengths that range up to over 600,000 psi. Wire can be fabricated in high speed automatic wire forming machines to form complex products to high performance standards at very low cost. At American Steel and Wire, we draw round, square or hexagon wire, and can ship it in 1,000 pound coils that do not contain a single weld if you desire. ■ Our wire is manufactured to your specific end use product requirements, and is warranted to meet your specifications. ■ When you consider the usefulness of steel wire, is it any wonder that so many designers are looking at their products from a new angle in the hope that they can make a stunning design breakthrough with steel wire? After all, Charles Eames did it. American Steel and Wire, Rockefeller Building, Cleveland 13, Ohio. **Innovators in Wire**





TRADEMARK

**American Steel and Wire  
Division of  
United States Steel**

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### **Two-Inch-Dia Blower**

**320**

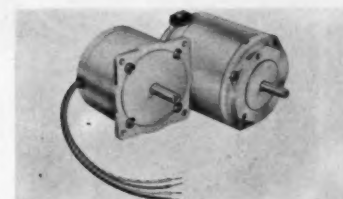


With a maximum length of 1-1/2 inches by 2 inches in dia, this vane-axial blower produces 50 cfm at 2.1 inches of water back pressure. Intended for use on aircraft and missiles, the blowers are available with a wide variety of 400-cycle motor options. The VAX-2-MC blowers are built with black-anodized aluminum castings and weigh 5 oz. They will meet appropriate military specifications.

Globe Industries, Inc., 1784 Stanley Ave., Dayton 4, Ohio.

### **Stepping Motor**

**321**



These motors may be used both as constant-speed a-c or d-c stepping and incremental-positioning devices. The bifilar types are designed for use where push-pull circuitry and a center-tapped power supply are not possible, or where increased torque with high speed is required. Bifilar motors can be stepped by switching from one half of the winding to the other. Four-lead types are offered for use with equipment requiring isolated windings having no common connection. With 60 cycles supplied, the units have a basic shaft speed of 72 rpm. The motors are available in 50, 100 and 250 oz-in torque ratings with d-c inputs from 2 to 50v.

Superior Electric Co., Bristol, Conn.

## PRODUCT APPLICATION

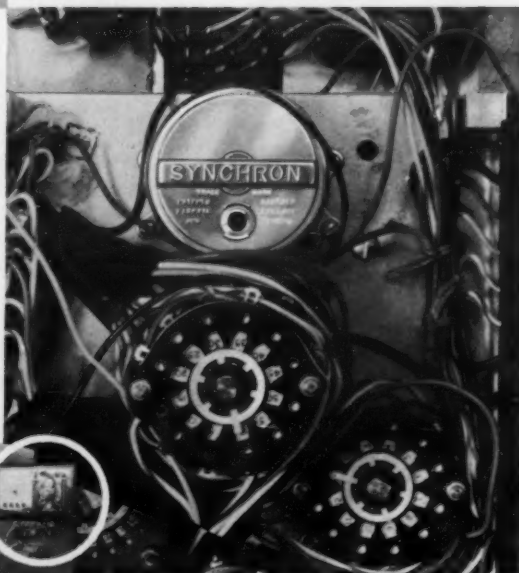
**HANSEN  
SYNCHRON  
TIMING MOTORS**

Hansen  
SYNCHRON  
motors,  
the "heart"  
controlling  
the split-second  
timing of  
Schulmerich  
Carillon  
Bells

Schulmerich  
electro-mechanical

## CARILLONIC BELL

systems...



SCHULMERICH CARILLONS, INC., world's largest manufacturer of electro-mechanical carillons, uses Hansen SYNCHRON Timing Motors to drive the program clock governing the all-automatic operation of these precision, perfect-tone instruments. Clock programming is offered at 15-minute intervals, 24 hours a day, 7 days a week. Scheduled to play at specified times, exactly to the minute — there is no allowance for plus or minus variation.

HANSEN SYNCHRON TIMING MOTORS were selected as an integral part of Schulmerich Carillon Bells because they outperformed all other motors tested. Carefully controlled testing was based on four specifications: (1) instantaneous starting, (2) no time loss or gain, (3) absence of malfunction, and, (4) reliable, continuous operation for periods of a year or more. Depending on installation, motors operate at either 110 or 220 volts — 50 or 60 cycles.

SEND TODAY for informative folder containing specifications and technical data on all Hansen SYNCHRON motors and clock movements.

### HANSEN REPRESENTATIVES:

**THE FROMM COMPANY**  
5150 W. Madison, Chicago, Illinois  
**H. C. JOHNSON AGENCIES, INC.**  
Rochester, N. Y. — Buffalo, N. Y. — Syracuse, N. Y.  
Binghamton, N. Y. — Schenectady, N. Y.  
**ELECTRIC MOTOR ENGINEERING, INC.**  
Los Angeles, Calif. — (Olive 1-3220)  
Oakland, California  
**WINSLOW ELECTRIC CO.**  
New York, N.Y. — Essex, Conn. (SOuth 7-8229)  
Philadelphia, Penn. — Cleveland, Ohio

Sweet's Product  
Design File



**HANSEN  
MANUFACTURING  
COMPANY, INC.**  
PRINCETON, INDIANA

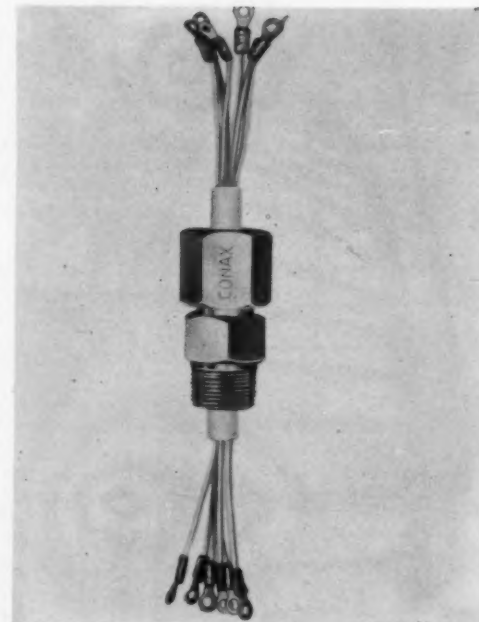
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## ELECTRICAL

### Electrical Lead Sealer

Electrical leads may pass through the walls of sealed pressurized equipment using one of these electrical-lead sealing devices. Having 2, 4, 6 or 8 holes, the unit consists of a ceramic insulator through which the protective covered wires fit. The ceramic with the wires is contained in a stainless-steel gland and, by tightening its cap, the assembly may be sealed for pressures up to 5000 psi. The sealing device is available with a selection of soft sealants. Specifications include a temperature range from -40 to 450F. Sizes are 9/16 to 1-1/2-inch hex. Mounting threads are 1/8 to 3/4 inch IPS.

Conax Electrical Lead Sealing Devices, Conax Corp., 2300 Walden Ave., Buffalo 25, N. Y.



322

## ASSURED SELF-LUBRICATING SECURITY WITH LUBRITE® Self-Lubricating BEARINGS



Construction Equipment



Baking Ovens & High Temp. Equipment



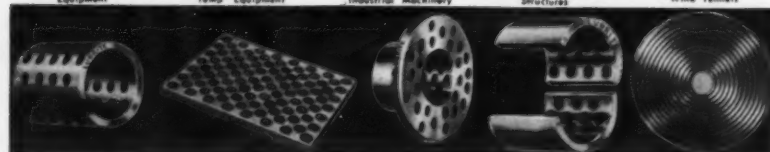
Steel Mills & Industrial Machinery



Compressors & Structures



Wind Tunnels



Materials Handling Equipment & Conveyor Systems



Chemical & Refinery Processing Plants



Paper, Food, Rubber & Textile Machinery



Hydro-Electric Gate Bearings and Accessory Equipment



Bridges

Lubrite self-lubricating bearings offer great versatility in hundreds of fields where dependability and superior performance are of prime importance.

Lubrite Bearings, with clean, permanent, maintenance-free self-lubrication are designed to withstand severe loadings, temperature extremes, submersion, corrosion and other adverse conditions.

Lubrite may be just the bearing you need in your designs to obtain better results.

Consult our Engineering Department on your application. No obligation.

Send for this free 20-page Lubrite Manual No. 55—it contains complete information, technical data and specifications about Lubrite Self-Lubricating Expansion Plates and Bushings. Write today!



Now Available—New Manual No. 56 with complete technical information about LUBRITE SELF-LUBRICATING BUSHINGS, BEARINGS & WASHERS.

Write for your copy.

**LUBRITE DIVISION  
MERRIMAN BROS., INC.**

198 AMORY STREET, BOSTON 30, MASSACHUSETTS

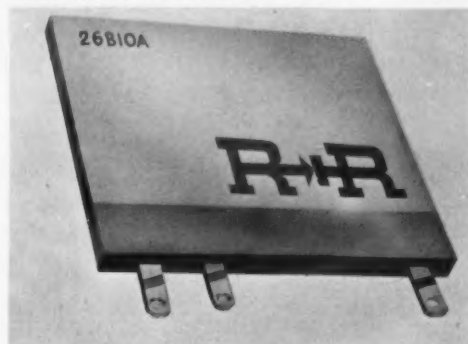
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DESIGN NEWS—NOVEMBER 10, 1961



### Sealed Selenium Rectifier

323

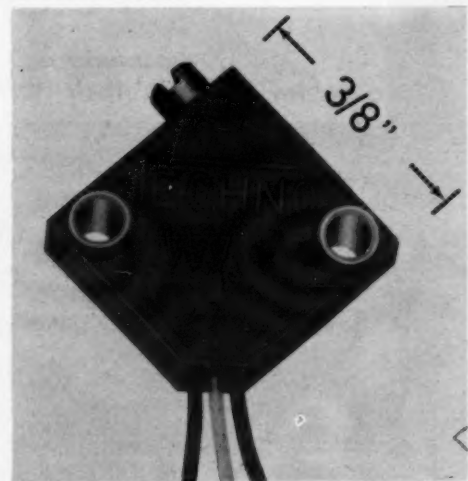


Epoxy sealing and flat mounting against a chassis keeps these high-power selenium rectifiers cooled. With ratings to 250 volt-amperes or higher, the available units include half-wave, doubler and bridge configurations in single-phase or three-phase circuits. Units may be obtained for voltages up to 130v rms input and current outputs to 10 amps d-c. This is based on an allowable case temperature of 150F.

Radio Receptor Co., Inc., 240 Wythe Ave., Brooklyn 11, N. Y.

### 3/8-Inch Wirewound Potentiometer

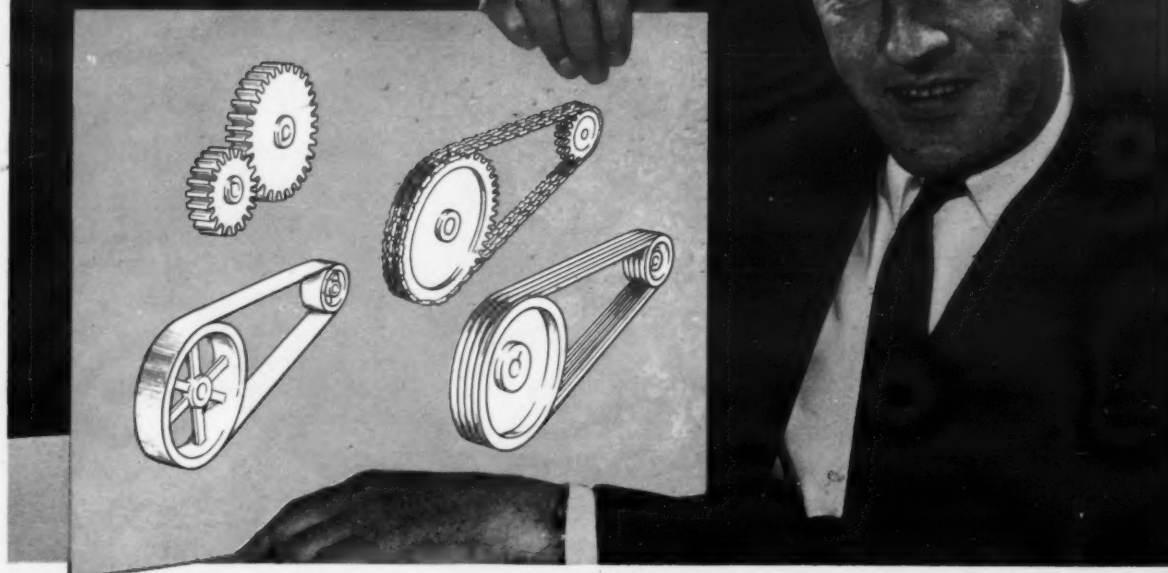
324



Available with a resistance range from 100 to 20,000 ohms, this continuous-rotation unit measures only 3/8 inch square. Weighing 3/4g, the potentiometer is rated at 1/2w at 50C, derated to 0 at 105C. The trimmer withstands vibration of 50G from 10 to 2000 cps and has a temperature coefficient of 50 ppm per deg C. As a voltage divider, stability is rated 0.2 percent. Housed in a high-temperature plastic (diallyl phthalate) case, the unit uses a stainless-steel adjusting screw with a ratio of 25:1. Expected price for small-quantity lots is under \$3 per unit.

Techno-Components Corp., 18232 Parthenia St., Northridge, Calif.

*Now, redesign...  
if these drives give you trouble*



## Ask your local Gates Man to show you how Super HC Drives reduce machine down-time

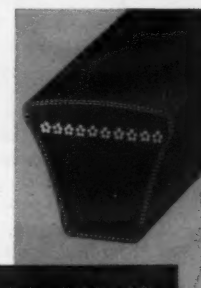
If you have a chain, gear, flat belt or even a conventional V-belt drive that is causing costly production down-time or high maintenance costs, your local Gates Man will be glad to help you. He will show you how these troubles can be ended by using a Gates Super HC V-Belt Drive—the first and most advanced High Capacity drive.

Because of exclusive design features, Gates Super HC V-Belts handle up to 3 times the horsepower of conventional V-belts in the same space—or they can often handle the required horsepower in about half the space. Fewer belts are needed, and sheaves can be smaller and lighter weight.

As a result, bearing loads are less, increasing bearing life, reducing maintenance costs.

Gates Super HC Drive is quiet, smooth-running and entirely dependable—multiple belts assure you of continuous operation, ending costly production losses. It is a highly resilient drive that protects your machine from vibration and damaging shock loads, increasing machine life and lowering maintenance costs—savings that often amount to many times the cost of the drive.

*Your local Gates Man is an experienced, fully-qualified drive design expert. Contact him for drive design help.*



There is a Gates Man—a drive expert—located near you:



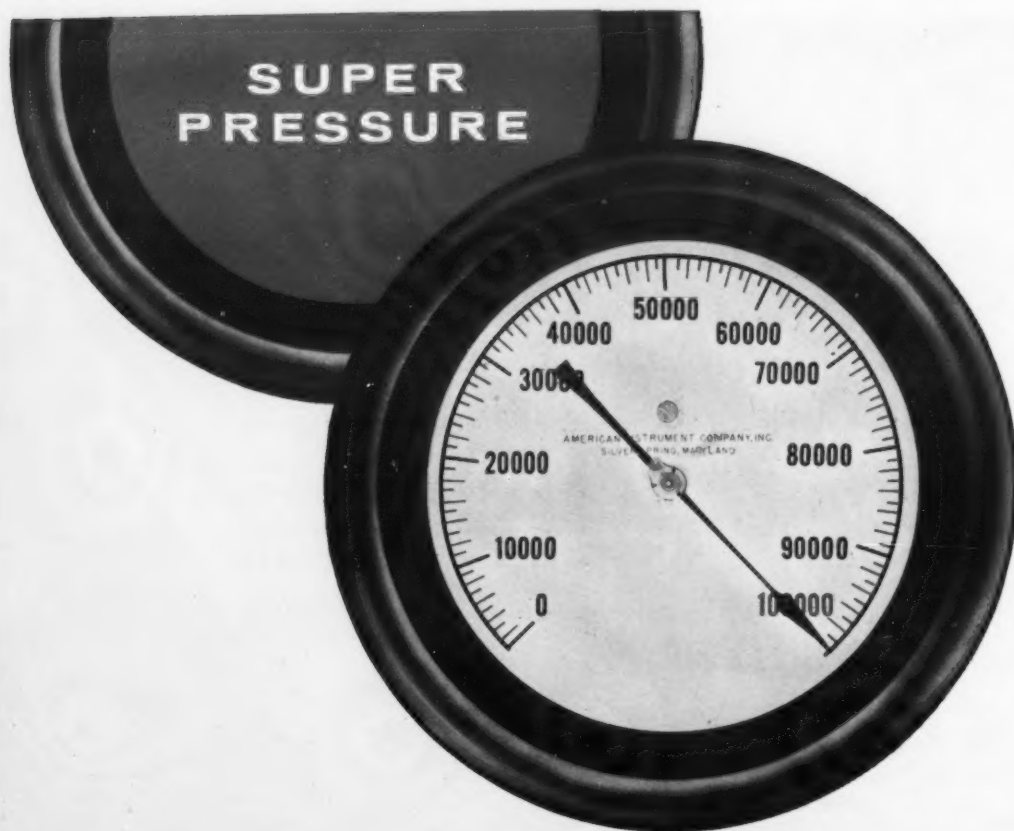
The Gates Rubber Company, Denver, Colorado

# Gates Super HC V-Belt Drives

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Building the future on 50 years of progress



*when the needle moves up to 100,000 p.s.i. . . .*

## **... A MAN WANTS DEPENDABILITY BACKING IT UP!**

This is what Aminco offers the high-pressure worker . . . maximum protection and dependability! For the past 40 years, Aminco valves, fittings, and tubing have been used widely in government and industrial installations, wherever super-pressures must be contained in leak-proof, efficient systems.

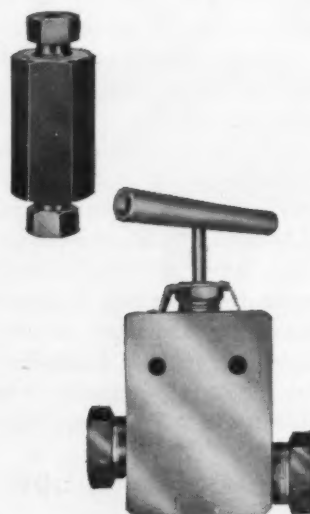
Aminco manufactures three distinct families of valves, fittings and tubing . . . the Superpressure line for pressures up to 100,000 p.s.i. . . . the Quickseal line for fast installation at pressures to 10,000 p.s.i. . . . and a new line of pipe-sized valves and fittings (1/2 in. to 2 in. nominal pipe-size) for pressures up to 10,000 p.s.i. These new components are made with lens ring gaskets in union type joints, designed so that tightness of the joint increases as pressure increases.

All three groups are illustrated and described in Aminco's 125-page Superpressure Catalog, free on request. Catalog also includes autoclaves, pumps, compressors, pressure balance, reaction vessels, custom-built equipment — All the newest equipment for high pressure-temperature work.

Send for Aminco Superpressure Catalog 460-02

**AMINCO**

8030 Georgia Ave., Silver Spring, Md.



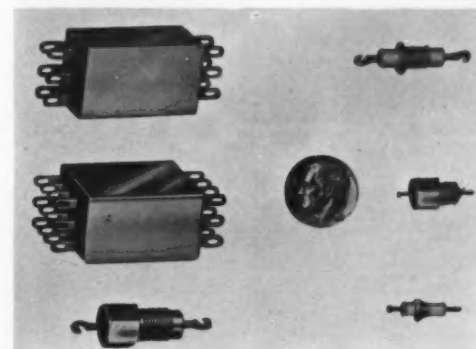
# AMINCO

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## **ELECTRICAL**

### **UHF Filters**

**325**



Designed for the OEM and electronic parts market, these three-terminal, high-frequency, low-pass filters are used to eliminate parallel resonance peaks in the UHF range from 100 to 2000 mc. At 500 mc, the transfer impedance of one of the filters is below 0.01 ohm. The small filters make use of the flat temperature characteristic "Hi-K" ceramic dielectrics and temperature stable ferrites developed by the manufacturer.

Erie Resistor Corp., Erie, Pa.

### **Lampholder for Midget Bulbs**

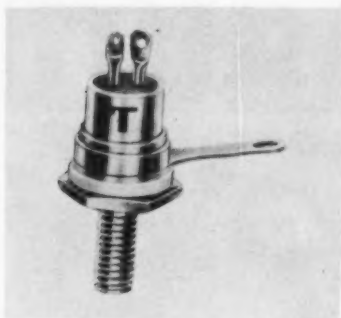
**326**



Used with the T/TL 1 3/4 midget groove lamp, this lampholder allows pilot lights to be panel mounted only 1/4 inch apart. The WE 700 Series lampholder is supplied with a 6-inch length of 22-gage wire. A variety of standard and panel mounting brackets is available, together with plastic lens caps of many colors.

Webster Electronics Co., Inc., 237 Lafayette St., New York 12, N.Y.

### Insulated Collectors 327

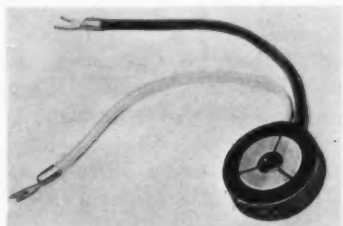


Transistor circuits which require the collector to be insulated from a chassis are no longer a problem. Ceramic cases are now available which eliminate the need for insulating hardware. Electrically and thermally, the units are identical to the devices having the collector connected to the case.

Transitron Electronic Corp.,  
168 Albion St., Wakefield, Mass.

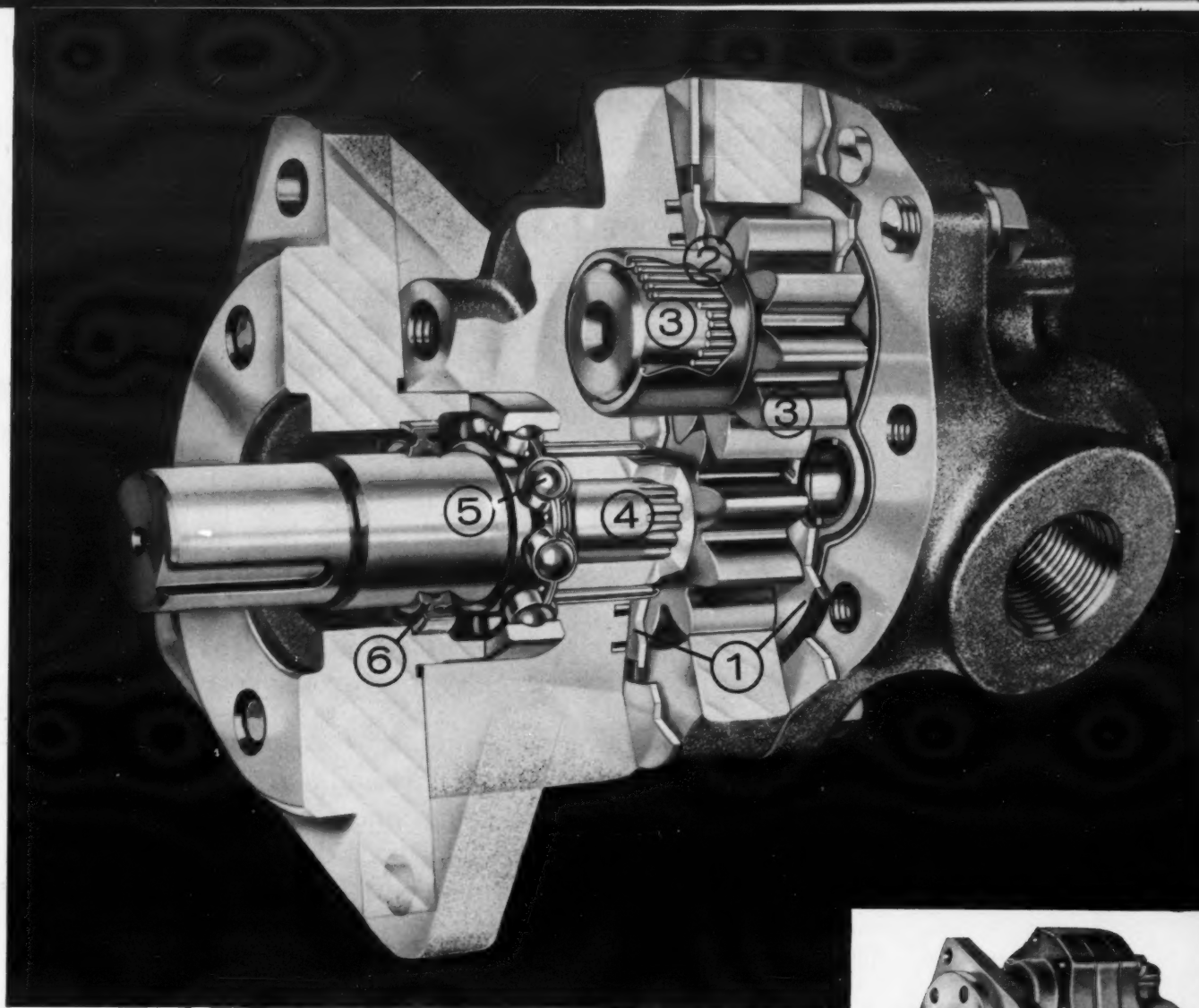
### Thermoelectric Transistor Cooler 328

Power dissipation of stud-mounted diodes and transistors may be increased by the use of this thermoelectric cooling unit. The F-3DC cooler consists of three TE couples. Heat is pumped from the component case and rejected to chassis, fins or other heat sink.



The unit operates at a voltage of only 0.3v and a current of 17 amps maximum. A temperature difference of 65C is provided at no load.

General Thermoelectric Corp.,  
Box 253, Princeton, N.J.

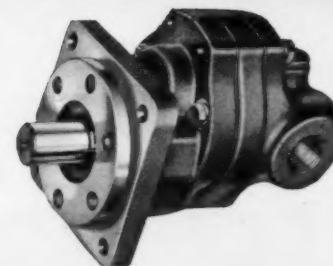


## Here's how WEBSTER puts new efficiency in hydraulic power

We cut this new JE series pump in half to show you why Webster design tops competition in overall efficiency. Specifically, the JE saves horsepower, slashes operating costs, delivers dependable and trouble-free service.

It's the result of this combination of advanced features... (1) pressure-balanced wear plates for high volumetric efficiency and to prevent clearance changes due to heat; (2) needle bearings for power-saving, anti-friction operation; (3) one piece gear and bearing journal units to assure minimum deflection and proper alignment on both drive and idler assembly; (4) free-floating internal spline drives to eliminate key failures; (5) thrust bearing on drive shaft to absorb compound driving thrusts; (6) double lip seal on drive shaft for added protection against seal failure and dirt.

The Webster JE series pump is a heavy-duty, big power unit built to meet the needs of the mobile industry. It is trim and compact to fit into tight quarters, attaches with a choice of mountings. Your Webster Electric representative has complete specifications and data — or write direct for engineering detailed sheet HY1-1.



### JE SERIES PUMPS

- Shaft seal: double lip type
- Drive: direct, gear or belt
- Capacity: 10 sizes — 5 to 40 gpm
- Pressures: to 2000 psi
- Operating Speeds: to 2400 rpm
- Porting: side (std.) end (opt.)
- Mounting: SAE Type A (std.)

OIL HYDRAULICS DIVISION

WEBSTER  ELECTRIC  
RACINE · WIS



## General Electric Makes Eddy-current-coupling Drives

And they're dependable drives. The complete line includes water-cooled and air-cooled eddy-current couplings. We call them **KINATROL** drives. Ratings are from 1 to 150 horsepower, operating from standard a-c power.

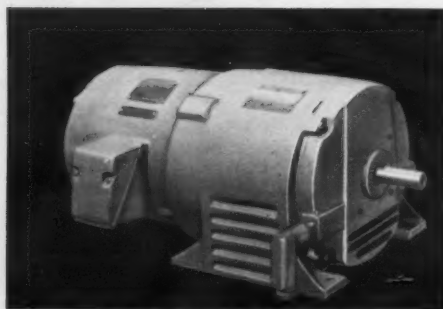
A General Electric **KINATROL** drive is not just another eddy-current coupling. For instance, in the water-cooled coupling, water control is packaged. You'll see much less external piping. Furthermore, the coupling is protected from flooding—and the air gaps are dry, preventing corrosion.

**KINATROL** couplings are compact, field proven and dependable. General Electric has had a good deal of experience in the engineering, manufacturing, and application of packaged adjustable-speed drives. And we know how important service is to a customer.

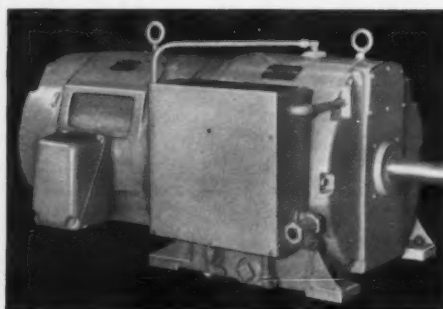
**KINATROL**—a good product, with the kind of service you can depend on. Please call your nearest General Electric Sales Office for further details.

\*Trademark of General Electric Company

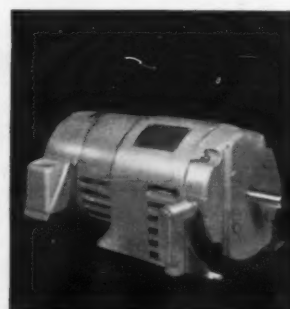
821-07



AIR COOLED, 7-1/2 to 100 HP



WATER COOLED, 25 to 150 HP



AIR COOLED, 1 to 5 HP

DIRECT CURRENT MOTOR AND GENERATOR DEPARTMENT

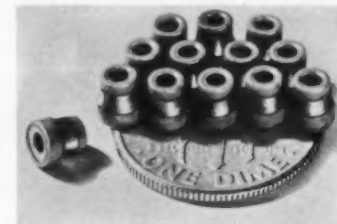
# GENERAL ELECTRIC

ERIE, PENNSYLVANIA

Circle 66 on Reader-Service Card for more information

## ELECTRICAL

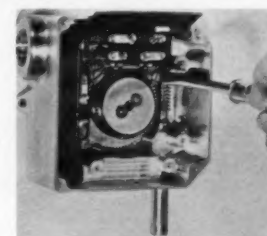
### Miniature Feed-Through Capacitor 329



Lead filtering should be made easier by the use of these microminature feed-through capacitors. Designed for miniature circuit use, the DA-718 is inserted in a 1/8-inch hole and soldered into position by means of its metallized shoulder. The capacitor is rated at 100v d-c working and 250v d-c test, and may be obtained in capacities of 500 and 800 MMF.

Centralab, Electronics Div. of Globe-Union, Inc., 914-Y E. Keefe Ave., Milwaukee 1, Wis.

### Rotating-Shaft Limit Switch 330



Multiturn devices can be controlled with this rotating-shaft limit switch. Offered in nine different gear ratios from 20:1 to 1280:1, the switch may be supplied with up to four snap-acting contactors, each able to control a separate function or all able to act simultaneously. Operating cam adjustment of the rotating-shaft switch may be performed with one hand, important for overhead mountings with the worker atop a stepladder. NEMA Type 1, 4 and 7 enclosed forms are available to adapt for specific environments.

General Electric Co., Schenectady 5, N. Y.

# Some Reasons Why DURA MECHANICAL SEAL is the Best to Buy



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**DURAMETALLIC CORPORATION**  
KALAMAZOO, MICHIGAN

Circle 67 on Reader-Service Card

## Variable Transformer

331

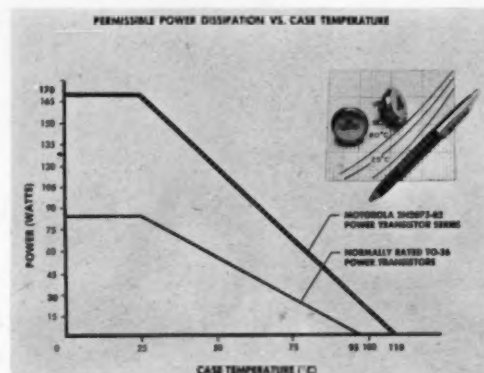


Resolution is said to be at least twice as fine as that of comparable units under full rated load in this variable transformer. Rated at 50 amps, 0-140v at 120v input, the Model T501U has a winding and brush arrangement that makes the better resolution possible. The unit has a solid-aluminum base which provides optimum heat transfer to the panel or bench to which it is fastened. The side-mounted replaceable brushes are held securely to the rotor and cannot spring loose under impact. The variable transformer measures 13-5/8 by 12-1/2 by 5-1/2 inches.

Standard Electrical Products Co., 2240 E. Third St., Dayton, Ohio.

## Germanium Power Transistors for 110C

332



A series of eight germanium power transistors has junction temperature ratings of 110C and power dissipation ratings of 170w.

Type	$h_{FE} @ I_C = 5A$	$BV_{CES}$
2N2075	20-40	80
2N2076	20-40	70
2N2077	20-40	50
2N2078	20-40	40
2N2079	35-70	80
2N2080	35-70	70
2N2081	35-70	50
2N2082	35-70	40

Motorola Semiconductor Products Inc., Technical Information Center, 5005 E. McDowell Rd., Phoenix 8, Ariz.

ONE OF THE  
ONE DOZEN REASONS WHY  
UNITED "POP" RIVETS  
run rings around the rest

**HIGH GRIP STRENGTH**

Exerting a "squeeze" between parts up to 600 pounds without distortion or danger of stripping, "POP" Rivets are ideal for every fastener application that calls for high grip strength combined with fast, economical setting. Equally important, you can always be sure of dependably high fastening quality and completely uniform clinching action, because the grip strength of "POP" Rivets depends on the carefully controlled breaking point of the setting mandrel... not on the strength or skill of your operators.

Remember, uniformly high grip strength with dependable fastening quality is just one of the one dozen reasons why "POP" Rivets run rings around the rest. If you're interested in improving the quality, appearance and sales appeal of your products... and reducing costs at the same time... be sure to investigate all the reasons that make "POP" the first choice for modern fastening. Write today for complete details and the name of your local "POP" Distributor.

Genuine "POP" Rivets Are Available Through a Large Network of Distributors Throughout The Country.

**UNITED "POP" RIVETS**

**HERE'S HOW THEY WORK**

"POP" Rivets are inserted and set from the same side: (1) Rivet is inserted in the work. (2) Jaws of the easy-to-use setting tool grasp the mandrel. (3) Tool is operated. Jaws pull back. Rivet is set. Mandrel breaks and falls free.

SETTING TOOL  
JAWS  
PULL BACK  
MANDREL BREAKS AND FALLS FREE

SHELTON DIVISION • UNITED SHOE MACHINERY CORPORATION  
2125 River Road, Shelton, Connecticut, U.S.A.

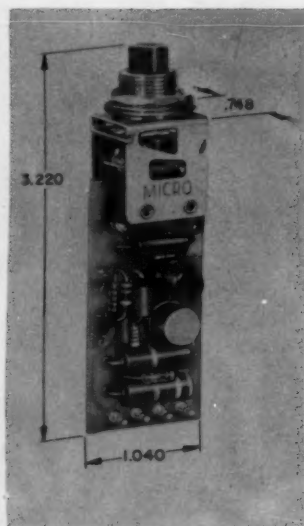
Circle 68 on Reader-Service Card for more information

## ELECTRICAL

### Single-Pulse Switch

333

Troubles caused by dirty or bouncing switch contacts are overcome by use of this long-pulse "one-shot" switch. Using its own electronic circuit, the switch eliminates the need of engineering special pulse input circuits for high-speed electronic switching devices. Output is a square wave pulse, fac-



tory adjustable from 30 to 500 millisecc and with an amplitude from 6 to 55v. Both width and amplitude are independent of the speed and length of switch operation. The unit should be especially valuable for pulsing relays, firing circuits and digital computers.

Micro Switch Div., Minneapolis-Honeywell Regulator Co., Freeport, Ill.

Circle 69 for Reader Service

WEATHERHEAD FLUID POWER PRODUCTS...SYSTEM ENGINEERED

# NEW! WEATHERHEAD VARIABLE DISPLACEMENT HYDRAULIC PUMP UNMATCHED... ANYWHERE!







The new W07 pump gives economy and performance advantages unmatched in high pressure, fluid power system applications. No other mass-produced, variable displacement hydraulic pump can now offer all these benefits:

**INSTANT RESPONSE...** hydraulically balanced, direct cylinder block actuation at lower power level without linkages.

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**CONTROL VERSATILITY...** pumping forces virtually eliminated from the displacement changing mechanism.

**HIGH TEMPERATURE CAPABILITY...** unique piston actuation permits fluids of low lubricity.

**PUMP ECONOMY...** size and weight are adaptable to a variety of applications; top reliability ensured with no selective fits.

Pressure compensation control is provided as standard and integral part of the pump in adjustable pressure ranges from 250 psi to 3000 psi.

The W07 pump incorporates J.I.C., S.A.E. and A.N.D. design requirements for industrial and mobile applications; meets stringent requirements of military specifications. Spline or keyway shafts are available.

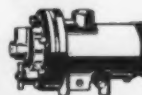
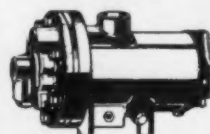
Application and design data are available from your nearby Weatherhead sales engineer. Direct inquiries to:

**THE WEATHERHEAD COMPANY**  
HYDRAULICS AND PNEUMATICS  
300 EAST 131st STREET • CLEVELAND 8, OHIO

## WEATHERHEAD HYDRAULIC POWER Components



### VARIABLE DISPLACEMENT PUMPS

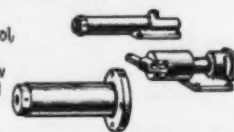


Meet J.I.C.,  
S.A.E., and M.S.  
standards.  
Pressures  
to 3000 psi



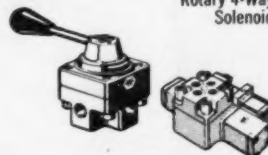
### PUMP CONTROLS

Pressure Control,  
Automatic  
(Constant) Flow  
Control, Manual  
Displacement  
Control



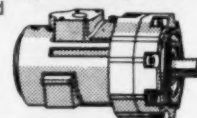
### DIRECTIONAL CONTROLS

Rotary 4-Way Valves  
Solenoid Valves



### HYDRAULIC DRIVES

Fixed Displacement Hydraulic Motors;  
Reversible Variable Displacement Hydraulic  
Motors (Integrated  
Torque and  
Speed Control)



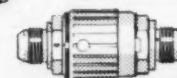
### HIGH PRESSURE HOSE AND FITTINGS

Swaged, Crimped, and Field-Attachable  
Flexible Hose Ends.  
Flared and Flareless  
Tube (Pipe) Fittings.  
Integral Check Valves



### SELF-SEALING COUPLINGS

Ball Check Valve Type  
Full-Flow Rotary Ball Type



## Rugged 6W Bulb

334

An incandescent lamp smaller than any previously designed by the manufacturer operates on standard voltage circuits. The rugged 6w bulb measures 1/2 inch in dia by 1-7/16 inches long, including its candelabra screw base. The new lamp uses two separate 3w coiled-tungsten filaments connected in series. The unusual filament design produces 36 lumens of light spread so that it can be used effectively with lenses of all colors in dial lights or other indicator applications. Average bulb life is 1500 hr at the rated 125v.

General Electric Co., Large  
Lamp Dept., Nela Park,  
Cleveland 12, Ohio.

## Printed-Circuit Trimmer

335



With a diameter of only 3/8 inch, this miniature ceramic trimmer has terminals intended for printed-circuit mounting. The right-angle bend of the terminals allows the trimmer to be adjusted horizontally, eliminating the need for vertical clearance. The small capacitor has a minimum "Q" of 500 at a frequency of 1 mc. The trimmer is offered in four different temperature coefficients and in capacitance ranges from 2 to 35 MMF.

Erie Resistor Corp., 644 W.  
12th St., Erie, Pa.

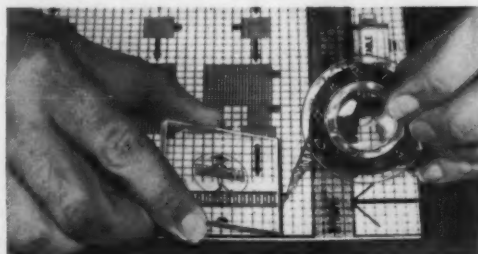
Circle 69 for Reader Service

# DRAWING BOARD NEWS

No.

2

Published by Chart-Pak, Inc., originator  
of the tape method of drafting.

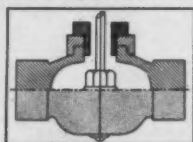


## CHART-PAK TAPES LIGHTEN THE LOAD OF OVERWORKED DRAFTSMEN

Chart-Pak is good news for designers and draftsmen. It cuts down on routine "pencil pushing." It leaves more time for creative work.

Lines, bars, shapes, patterns and symbols don't have to be drawn. With Chart-Pak, they come on pressure-sensitive tapes and sheets. They just *press* down . . . quickly, neatly.

Even curved lines, as small as  $\frac{1}{64}$ " wide can be "taped" on. And Chart-Pak is "goof-proof," too. It is easily lifted and moved . . . yet won't come off accidentally.



**Chart-Pak  
Shading Films stick  
without burnishing  
— won't skid**

Chart-Pak shading films have a water-clear adhesive that sticks tightly to tracing cloth or paper with light pressure . . . without laborious rubbing down. They are also "skid-proof," even in hot reproduction machines. More than 100 patterns and 27 color tints available, on DuPont "Mylar"®.

## PRE-PRINTED TITLE BLOCKS SAVE WORK

Draftsmen save work on every drawing, with "press-down" title blocks from Chart-Pak. Available printed to order — to read "right" or "reverse" — on clear or matte film. Quotations furnished on request.

DESIGNED BY	DATE	FILE
CHECKED BY	SCALE	BY
DRAWN BY	APPROVED	
YOUR COMPANY		

NEW!  
"TAPE-SAVER"  
PACKAGE

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take the drudgery out of drafting!

**CHART-PAK, INC.**

ORIGINATOR OF THE TAPE METHOD OF DRAFTING

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Dealers in principal cities in U.S. and Canada

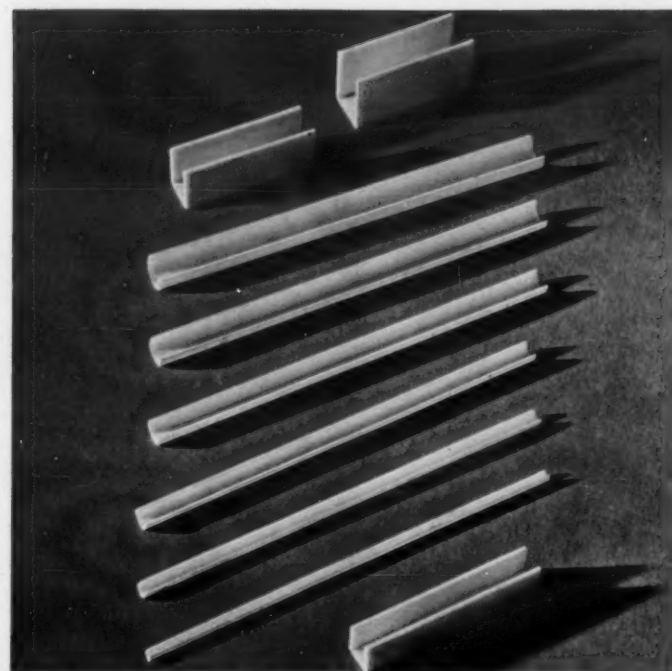
Circle 70 on Reader-Service Card for more information

## MATERIALS

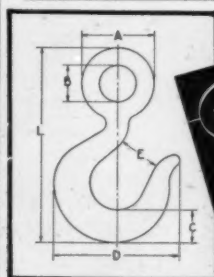
### Commutator Wedges

A line of high-temperature channel-slot wedges for electric motors, generators and other rotating equipment is available for use in Class H, F and B service. The wedges for Class H service are made of silicone-impregnated woven glass cloth. Those for Class F service are of epoxy glass and the wedges for Class B service are of polyester glass. Wedges are offered in standard sizes ranging from  $\frac{1}{8}$  to  $\frac{1}{2}$  inch. Custom wedges can be made to order in any of the three temperature ratings and in a wide variety of shapes. The "Silcobest" Class F epoxy-glass wedges are said to be the first with this temperature rating available in a complete choice of sizes.

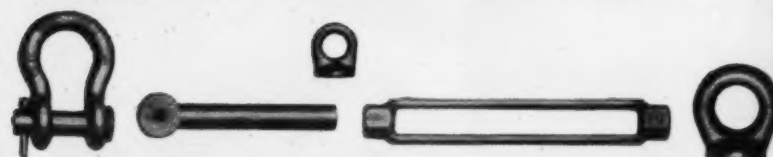
Silicone Insulation, Inc., 1383  
Seabury Ave., Bronx 61, N. Y.



336



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Division of  
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\*Free catalog gives application data for 2000 types and sizes of forged fittings for wire rope and chain. Ask your industrial distributor for your copy.

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DESIGN NEWS—NOVEMBER 10, 1961



## Foolproof Epoxy

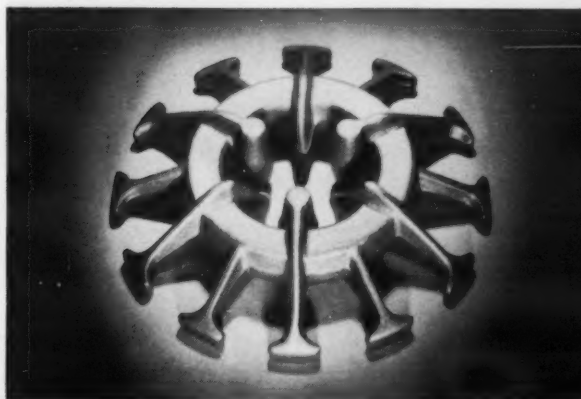
337

The simple mixing instructions for this two-part epoxy adhesive are said to make it nearly foolproof. Part A is colored cherry red, Part B a clear amber. The two are combined in equal parts by volume and mixed until all striations of color disappear and a uniform tint is achieved. The mixed adhesive is free-flowing and may be applied with spatula, paint roller, brush or standard two-part epoxy spray equipment. The red color provides a visual check and skipped areas may be corrected instantly. "Bondmaster M666" is a 100-percent reactive undegraded epoxy adhesive. Fully cured metal-to-metal bonds produced with this adhesive yield up to 3500 psi when tested at room temperature using MIL-A-5090B procedures. Bonds involving expanded "styrene" foam withstand 175F for 200 hr without cell attack. A 1-gal mixture of the adhesive has a pot life of approximately 1-1/2 hr at room temperature.

Rubber & Asbestos Corp., 225 Belleville Ave., Bloomfield, N. J.



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Monel  
Titanium

### FORGING METHODS

Drop-Hammer  
Steam Hammer  
Mechanical Press  
Upsetting  
Coining  
Restricting  
Open-Frame Hammer

**CLEANING METHODS**  
Pickling  
Shot Blasting  
Grit Blasting  
Tumbling

### HEAT TREATMENT

Normalizing  
Annealing  
Spheroidizing  
Hardening  
Tempering  
Stress Relieving  
Austempering  
Pack Carburizing  
Liquid Carburizing  
Solution Treating  
Precipitation Treating

### FINISHING OPERATIONS

Broaching  
Milling  
Drilling  
Tapping  
Threading  
Turning  
Coining  
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Chrome-Plating  
Cadmium Plating  
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## MATERIALS

### 'Teflon' Felt 338

"Teflon" is now available as a felt for industrial applications. Retaining the outstanding resistance to chemical and temperature attack of the basic material, these felts permit fine particle removal at high flow rate and with low pressure drop. The felts may be supplied in widths up to 72 inches and as long as 60 yd.

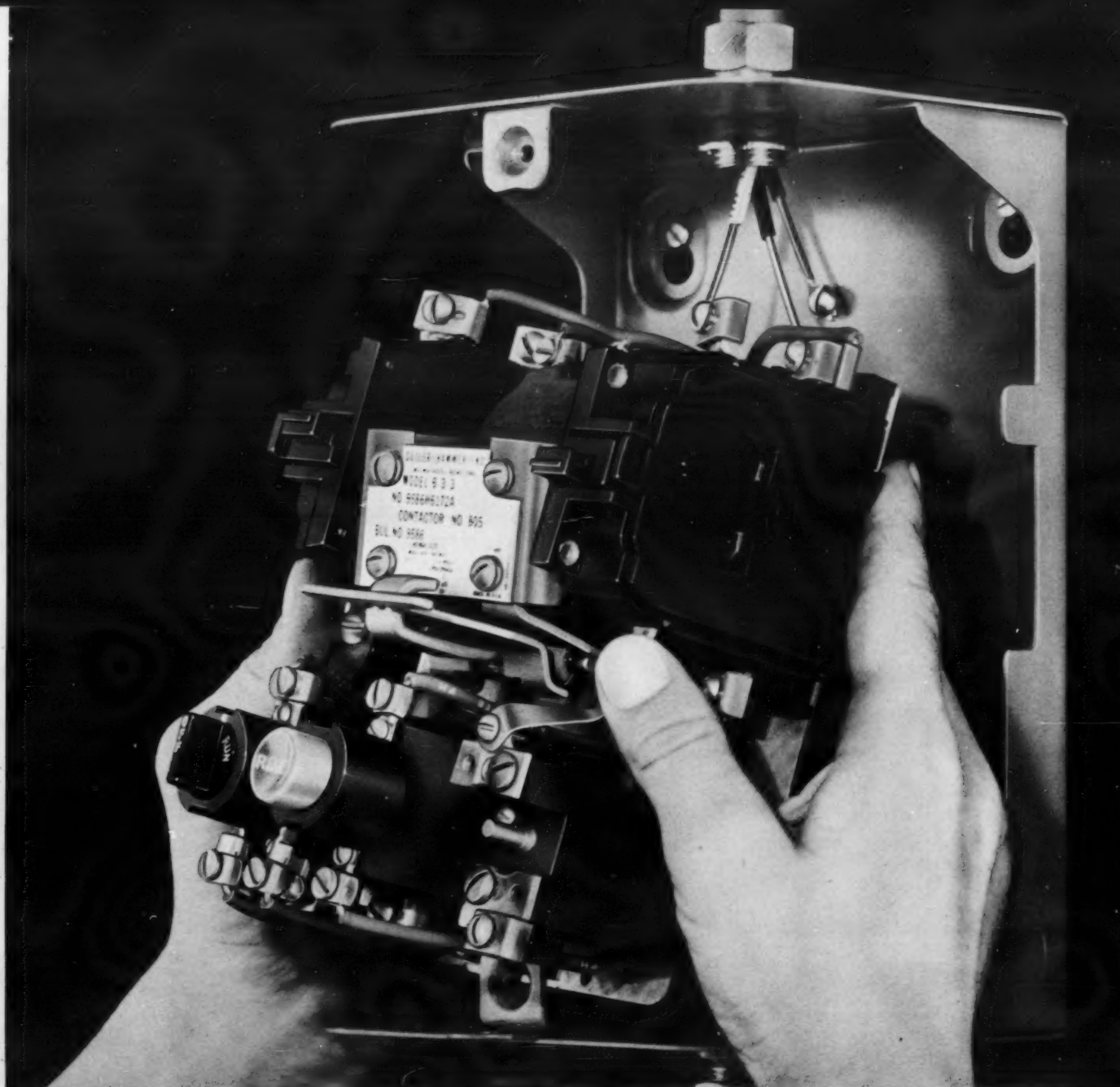
American Felt Co., 2 Glenville Rd., Glenville, Conn.

### Circuit Boards 339

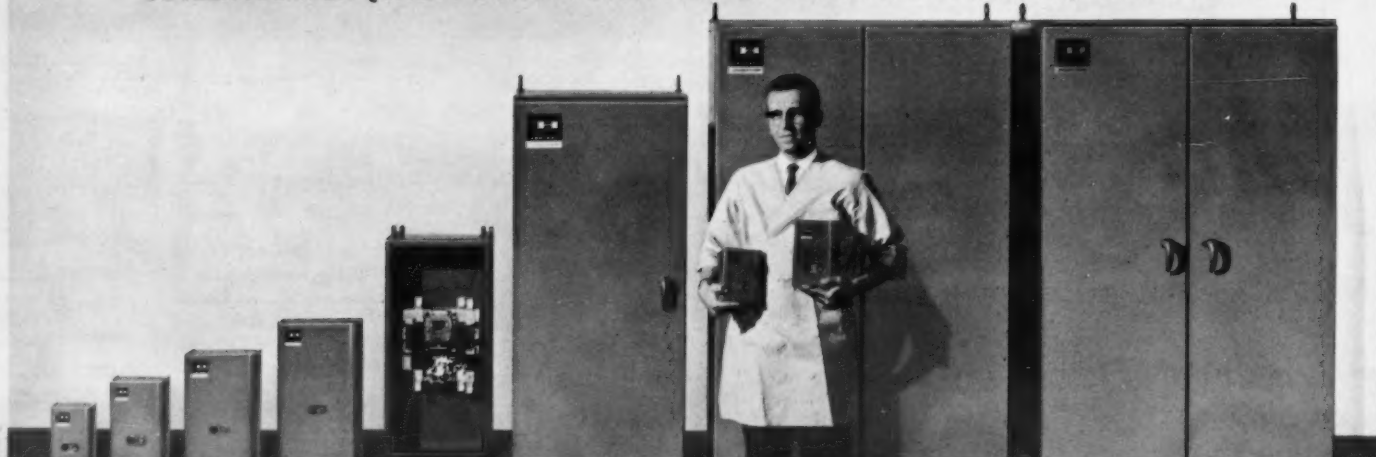


A glass-ceramic wiring board is now available with plug included. "Fotoceram" boards have a grid of 0.052-inch through-plated holes set on 0.1-inch centers. Circuit designer lays out wiring pattern on the copper-plated boards with etching resist. After a 15-minute etching process, the board is ready for mounting of components. Boards are supplied with silicone-rubber mounting grommet and are offered in 4- by 6- and 6- by 8-inch sizes.

Corning Electronic Components, Corning Glass Works, Bradford, Pa.



CUTLER-HAMMER QUALITY 3-STAR MOTOR STARTERS AVAILABLE IN 10 SIZES, 00 THROUGH 8





## CUTLER-HAMMER MOTOR STARTERS

# Still the proven standard of quality...always in stock for immediate delivery

Millions of satisfactory operations in thousands of applications have proved the unmatched quality of Cutler-Hammer across-the-line magnetic starters. That this line is still recognized as the leader—nine years after the original design was developed—is a great tribute to the years-ahead thinking of Cutler-Hammer engineers.

### FIRST IN '53—STILL THE LEADER IN '61

Since the Three Star line was introduced in 1953, many improvements have been made; magnet coils that far exceed NEMA standards, for example. But many achievements of the original design—vertical, dust-free contacts; overload relays adjustable to within 3% of actual full-motor ratings; provision for 2 or 3-coil overload relays in the same enclosure—are features no other manufacturer has been able to improve. You can safely bet that when these pace-setting features are improved, it'll be another Cutler-Hammer development.

### ALWAYS AVAILABLE FOR FAST DELIVERY

You'll find the smaller sizes of Cutler-Hammer Starters always in stock at your local distributors—larger sizes immediately available from the factory. We hope you'll make your own feature-by-feature comparison between the Cutler-Hammer line and any other starter on the market. Look especially carefully at such vital advantages as ease of installation, high interrupting capacity, coil construction and accessibility.

Regardless of what features you select as the criterion of superiority, we're sure you'll choose Cutler-Hammer after you've made your unbiased comparison.

If you're one of many companies being forced to stock two sets of parts because of design changes, now is an excellent time to standardize on Cutler-Hammer.

Call your distributor or local Cutler-Hammer Sales Office soon. Or write for Publication LO-70-W272.

### WHAT'S NEW? ASK..

## CUTLER-HAMMER

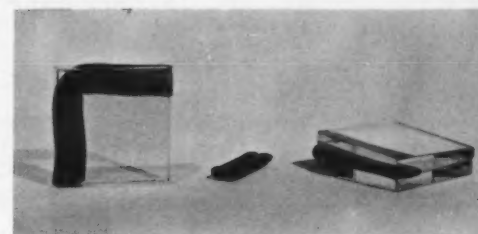
Cutler-Hammer Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A. • Associates: Cutler-Hammer Canada, Ltd.; Cutler-Hammer Mexicana, S. A.



Circle 73 on Reader-Service Card for more information

## Gasket Seals

340



Here is an extruded rubber-based gasket material which seals around corners without the need for splicing or special fitting. The material has a "double doughnut" cross-section which permits positive sealing of uneven or tapered joints and 90-deg bending. Two styles are available: EC-2121, which is hollow, permits greater compression in uneven seam; EC-2131, which is solid, and has better void-filling characteristics. The sealer has good adhesive properties and will remain in place until the mating surface is assembled.

Minnesota Mining & Mfg. Co., Adhesives, Coatings & Sealers Div., 900 Bush Ave., St. Paul 6, Minn.

## 3000F Paper

341



By using quartz fibers, this paper withstands temperatures as high as 3000F in intermittent operation. Uses for the paper include thermal blanket and high-temperature laminates. The material can be impregnated by the user with phenolic resin for heat-shielding applications where standard paper is not suitable. It is available in either sheet or roll form in thicknesses from 0.0015 to 0.085 inch and in widths from 1/2 to 84 inches.

C. H. Dexter & Sons, Inc., Windsor Locks, Conn.



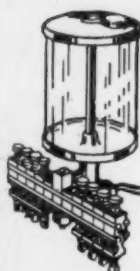
A COMPLETE LINE...for the finest in Automatic Lubrication

# OIL-RITE LUBRICATING EQUIPMENT



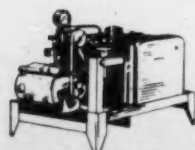
## DROP FEED OILERS

Low cost, dependable lubrication. Drop feeding adjusted by needle valve. Any setting may be locked. Shut-off toggle starts or stops oil flow. Available in many models and capacities from 1/4 oz. to 1 gal. with 1/4" to 1/2" pipe thread or for remote mounting.



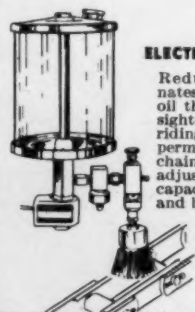
## ELECTRO OILERS

Lubricates up to 24 points from single reservoir. Oil is fed by gravity to individually adjustable outlets. Solenoid connected across motor—oil starts and stops with motor switch. Available in single or multiple feeds. Capacities 9 oz. to 1 gal.



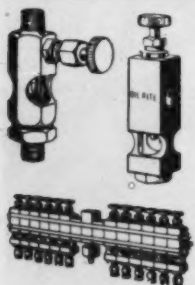
## DISPENSERS

Feeds oil to elevated, distant and inaccessible points for dispensing through valves. Ideal for dusty and dirty surroundings. Air operated or motor driven gear pump circulating oiling system available in a wide range of sizes and tank capacities.



## ELECTRO CHAIN OILERS

Reduces wear—eliminates hand oiling. Feeds oil through solenoid and sight feed valve to brush riding chain. Solenoid permits oiling only when chain moves. Drop feed adjustable. 9 oz. to 1 gal. capacity. Many styles and brush sizes.



## SIGHT FEED VALVES

For any application requiring adjustable visible needle valve control. Friction screw retains hair-line adjustments. Large vented sight chambers for observing oil flow. Many styles, single or multiple feed.



## LIQUID LEVEL GAGES

Rugged construction, with glass or plastic sights, revolvable shields and guarded vent hole. Can be taken apart for installation in tight places. Many styles and sizes in both plain and shielded, elbow or straight types.

## OIL-RITE offers you BETTER LUBRICATION...at BIG SAVINGS!

Looking for low cost oilers—automatic lubricating systems—ways to reduce costs and maintenance? You'll find the answers in the complete OIL-RITE line. OIL-RITE engineers with 25 years experience will gladly help you select the most suitable and economical model for your specific application. Consult us on your next requirements for lubricating equipment. There's no obligation.



Send for complete OIL-RITE CATALOG. Items shown above are only a few in the extensive OIL-RITE line.

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2331 Waldo Boulevard • Manitowoc, Wisconsin

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## MATERIALS

### Colored Circuit Boards

342



Printed wiring now can be produced on colored circuit boards. Used for color coding or for eye appeal, these copper-clad and unclad laminates are obtainable in red, blue, gray or jet black. The colored boards have the same dielectric strength as the natural green boards and conform to MIL-P-18177B and MIL-P-13949B. All colors are offered in standard thicknesses and sheet size is 24 by 42 inches.

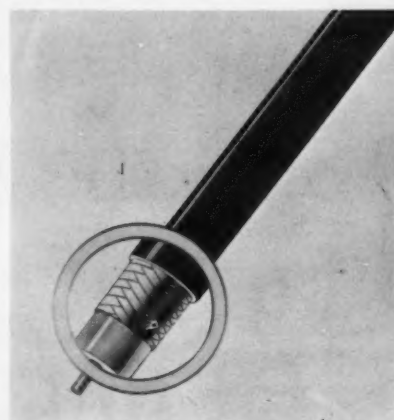
Fortin Plastics, Inc., 14811 Keswick St., Van Nuys, Calif.

### Woven Strip Coax Shield

343

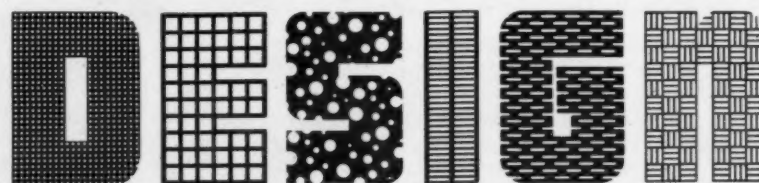
A reduction in weight amounting to 20 to 40 percent has been made possible by use of basket-woven flat-strip copper for coaxial cable shields. Designed for community TV systems, the technique has resulted in improved attenuation, radiation characteristics and impedance uniformity. The flat-strip shield also allows a smaller cable minimum OD.

Times Wire & Cable Div., International Silver Co., Wallingford, Conn.



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Harrington & King can perforate the proper design, pattern and open area in practically any metallic or non-metallic material available in coils, sheets or plates—from foil-thin to 1" thick. Specify H&K perforated materials on your next job.

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"Perforated Metals"

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### Insulating Varnishes

344

Diallyl phthalate and diallyl isophthalate resins now are offered as insulating varnishes. Already known as molding materials for electronic parts, these transparent coatings are useful for coating, sealing or dip encapsulating of capacitors, resistors, transformers, motor windings, transistors, diodes and form-wound coils. Two formulations are available—RAM 23-X4 for continuous temperatures to 150°C and RAM 23-X5 for temperatures to 180°C.

RAM Chemicals, Inc., 210 E. Alondra Blvd., Gardena, Calif.

### Nylon Air Hose

345

A spiraled nylon air hose, rated to 200 psi, now is supplied with a compression elbow fitting and a "nonslip" aluminum ferrule. The full-flow fittings lock tightly to the smooth surface of the "Nycoil" hose, permitting unobstructed air flow. The nylon hose is resistant to abrasion and corrosive materials and is unaffected by oil present in the air line. The bright red color of the hose and its self-storing ability may contribute to greater safety in the shop. The hose is available in standard 25-ft lengths with positive-lock fittings at each end.

Nycoil Co., Westfield 4, N.J.

### Junction-Box Adhesive

346

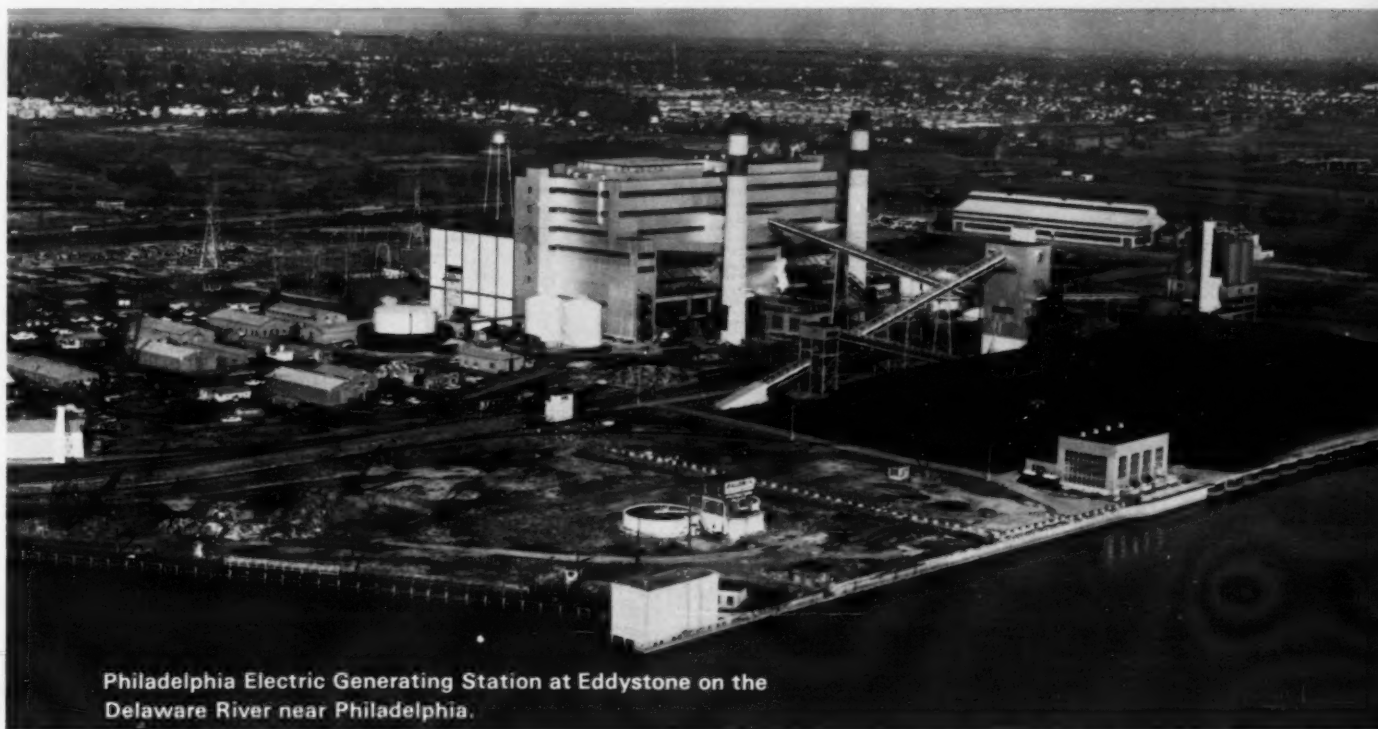
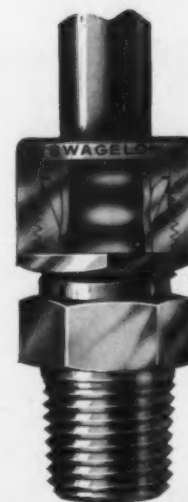
This adhesive is used to quickly mount electrical junction boxes on masonry walls, tile, ceilings, floors, metal beams or wood surfaces. The boxes may be mounted without need for drilling, bolts or plugs. Supplied as a two-part epoxy packaged in a compartmented cup, the material is guaranteed for a period of one year from the date of purchase and will not harden until mixed. The improved formulation for "Permacer PA 1041" junction-box mount adhesive is guaranteed against premature hardening prior to use.

Permacer, New Brunswick, N. J.

## WORLD'S MOST EFFICIENT POWER STATION SPECIFIES MOST EFFICIENT TUBE FITTINGS

Swagelok®

Philadelphia Electric Company's new Eddystone Station is an engineering achievement of which Americans can be proud. Representing a major breakthrough in the power industry, the Eddystone Electric Generating Station was designed as the world's most efficient power plant. This improvement in efficiency has been achieved by generating steam at a supercritical pressure of 5000 pounds per square inch and a temperature of 1200° F.

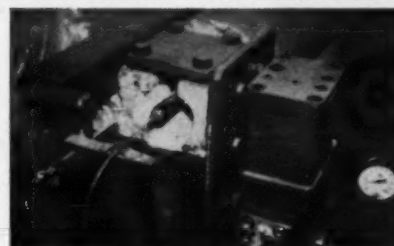


Philadelphia Electric Generating Station at Eddystone on the Delaware River near Philadelphia.

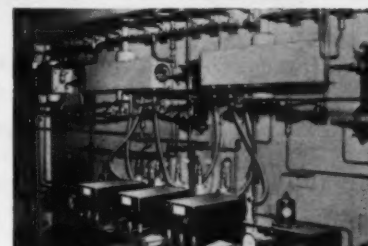
Housing two 325,000 kilowatt turbine generators, this giant station can produce enough power to supply the residential needs of a city of five million people.



Control Center for Eddystone Plant Operation.



Swagelok Tube Fitting used as a thermocouple connector on a main steam header #1 for boiler control. Operating conditions: Steam at 5000 psig — 1200° F.



Swagelok Tube Fittings used in control systems of supercritical pressure boiler.

Swagelok® TUBE FITTINGS

## EQUIPMENT

### Regulation Tester

347



A power supply's regulation may be tested with this dynamic load. The internal a-c impedance of a power supply may be measured at frequencies from 20 cps to 1 mc with the regulated supply providing up to 32v. Measurements may be taken with the d-c power supply current between 50 ma and 2-1/2 amps or with an a-c current up to 4 amps peak-to-peak. Measuring 9 by 7 by 12-1/4 inches, the unit weighs 15 lb and operates from 105 to 125v a-c, 60-400 cps at 0.25 amp.

Electronic Engineering Co. of Calif., 1601 E. Chestnut Ave., Santa Ana, Calif.

### Fluorescent Lights for Trucks or Trailers

348



This line of fluorescent light fixtures is designed to work on current from 6 to 32v storage batteries. Each unit is an integrated package consisting of a fluorescent tube and a high-frequency transistor inverter. Operation at a high frequency is said to result in much more candlepower for a given current input. Other advantages are the elimination of flicker effect and tube life beyond 10,000 hr. The unit also features reduction of starting difficulties common with ordinary fixtures at low temperatures. A full line of circular and straight-line fixtures is offered in both interior and exterior styles.

Daven Co., Rte. 10, Livingston, N. J.

All here . . .

components that satisfy

all pressure/flow system needs

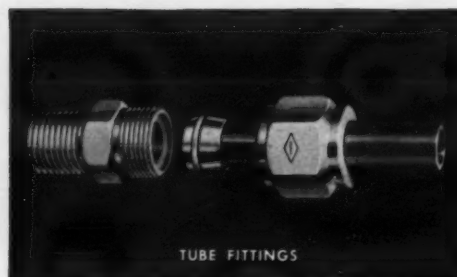
# IMPERIAL EASTMAN

Now together, Imperial-Eastman meets all your hydraulic-pneumatic-flow component needs: tube fittings, valves, couplings, flexible and rigid hydraulic lines, thermoplastic tubing and tubing tools.

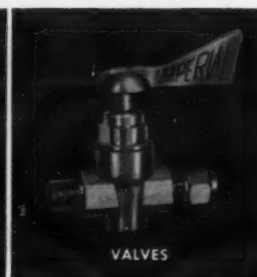
This *engineered* line gives you the exact product for every type of service condition—and the tools to make sure your assemblies are absolutely right.

For added satisfaction at your point of order, Imperial-Eastman products are available through highest caliber distributors.

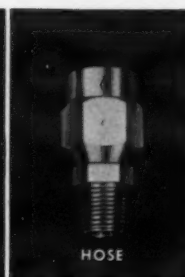
For complete information, write for Catalog No. 101.



TUBE FITTINGS



VALVES



HOSE

**IMPERIAL EASTMAN**

Imperial-Eastman Corporation General Offices

6300 West Howard Street, Chicago 48, Illinois

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DESIGN NEWS—NOVEMBER 10, 1961

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When we say *your most complete line* of pressure flow system components for all hydraulic, pneumatic, instrumentation and other applications—here's what we mean:

**TUBE FITTINGS OF EVERY TYPE AND SIZE—FOR ALL PRESSURES, TEMPERATURES**

- Hi-Seal® Butt Joint Fittings, Braze-Seal Hi-Pressure, Hi-Duty, 37° Flare, 45° Flare, Flareless, Flex, Compression, Inverted Flare, Threaded Sleeve and Plastic Tubing Fittings.

**FLUID CONTROL VALVES**

- Needle, Toggle, Diaphragm, Plug, Blow-Down and Kwik-Connect Types for pressures up to 5000 psi.

**HOSE AND COUPLINGS**

- Medium-Pressure Hose and Tube Assemblies, Couplings and Fittings for One-Wire Braid Hose
- High-Pressure Hose and Tube Assemblies, Couplings and Fittings for Multiple-Wire Braid Hose
- Low-Pressure Hose and Tube Assemblies, Couplings and Fittings for Fabric Braid Hose
- All Synthetic—for Pressures up to 3000 Lb.
- Adapter Unions, Adapters and Tube Fittings

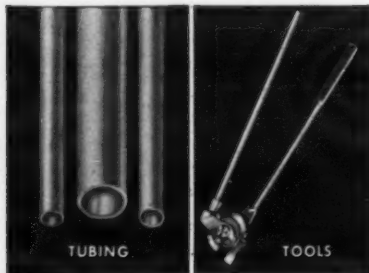
**TUBING**

- Plastic and Thermoplastic

**TUBING TOOLS**

- Cutting, Flaring, Bending, Reaming, Swaging, Pinch-off, Refacing Tools
- Service Aids

No doubt about it now—see your Imperial-Eastman distributor first for all hydraulic-pneumatic-flow system components.



**IMPERIAL EASTMAN**

Chicago 48, Illinois

**Electric Meter Calibrator**

349

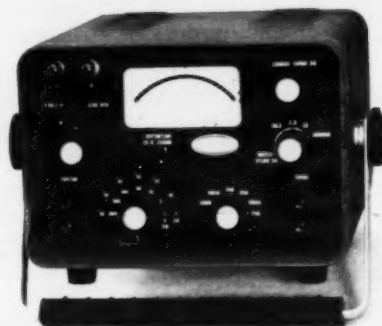


Almost any normal meter may have its accuracy checked with this electric meter calibrator. Having its own high-power output supply, the unit provides 54 ranges for checking both a-c and d-c volt and current meters. D-C voltages from 2 to 1000v and d-c currents from 20 microamps to 10 amps are provided. Two mv to 1000v a-c and 20 ma to 10 amps a-c are also available. The 0.5-percent panel meters of the instrument and 0.1-percent precision resistors allow a certified accuracy to 0.25 percent.

Twinco Inc., 10 Cheney St., Roxbury 21, Mass.

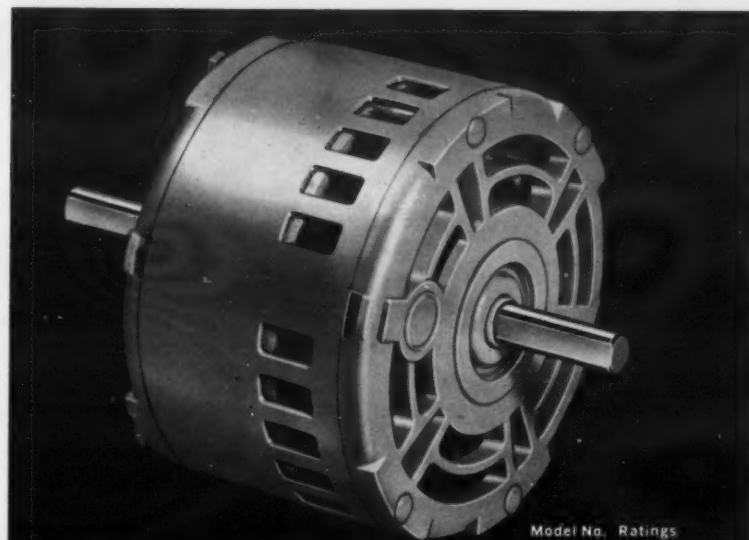
**Electronic Voltmeter with Expanded Scale**

350



The upper 10 percent or 1 percent of any of 14 d-c voltage ranges may be expanded to cover the full scale of this new electronic voltmeter. A-C or d-c voltages from 1 mv to 1000v in 14 ranges and resistances from 10 ohms to 10 megohms in 7 ranges provide good accuracy on all voltage functions. Internal circuitry of the R-21 insures that all d-c readings are upscale with indicator lights showing polarity of the voltage being measured. Residual noise is less than 20  $\mu$ v on the 1 mv a-c scale and d-c mv drift is less than 50  $\mu$ v after a five-minute warmup.

Hathaway Instruments, Inc., Hathaway Denver Div., 5800 E. Jewell Ave., Denver 22, Colo.



Model No. Ratings

**MODEL 6E**—permanent split capacitor, 6 pole, 1050 rpm. Quieter and cooler running than other current design motors, this L-N motor can put an end to problems of high current drain with low current requirements. Excellent power factor and efficiency in room air conditioning use.

646E	1/3
486E	1/4
406E	1/6
326E	1/10
246E	1/15

Shaded pole motors  
(1/150 to 1/4 hp)  
and PSC motors  
(1/15 to 1/3 hp)



**EFFICIENT! DEPENDABLE! LOW COST!**

**SPECIFY LEECE-NEVILLE MOTORS**  
to upgrade quality in air conditioners,  
refrigeration, pumps, fans, heating units

Leece-Neville offers you a complete line of shaded pole and permanent split capacitor A.C. motors and fractional D.C. motors—with horsepower ratings from 1/150 to 1/3 hp. All L-N motors are capable of meeting U.L. or C.S.A. application tests. Select a basic unit modified to your specification, or a special motor (custom engineered) to meet your requirements. Modern facilities assure top quality and delivery to your schedules. For complete information, write The Leece-Neville Company, Department DN-11, Georgia Division, Gainesville, Georgia.



**D.C. MOTORS**—Leece-Neville custom engineers more than 300 new D.C. Motors every year for car, home and industry. For details, write D.C. Motor Division, Cleveland 3, Ohio.



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## EQUIPMENT

### Miniature Tools

357

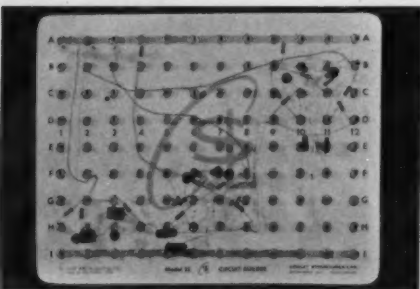


Measuring only 2-1/2 inches overall and with a 1 by 9/16-inch plastic handle, these miniature nut drivers are designed for assembly of miniaturized equipment. Sizes available are 5/64, 3/32, 7/64, 1/8 and 5/32 inch. In addition to the nut drivers, miniature end wrenches and screwdrivers may be obtained.

Hunter Tools, Div. of R. N. Hunter Sales Co., 9851 Alburdis Ave., Santa Fe Springs, Calif.

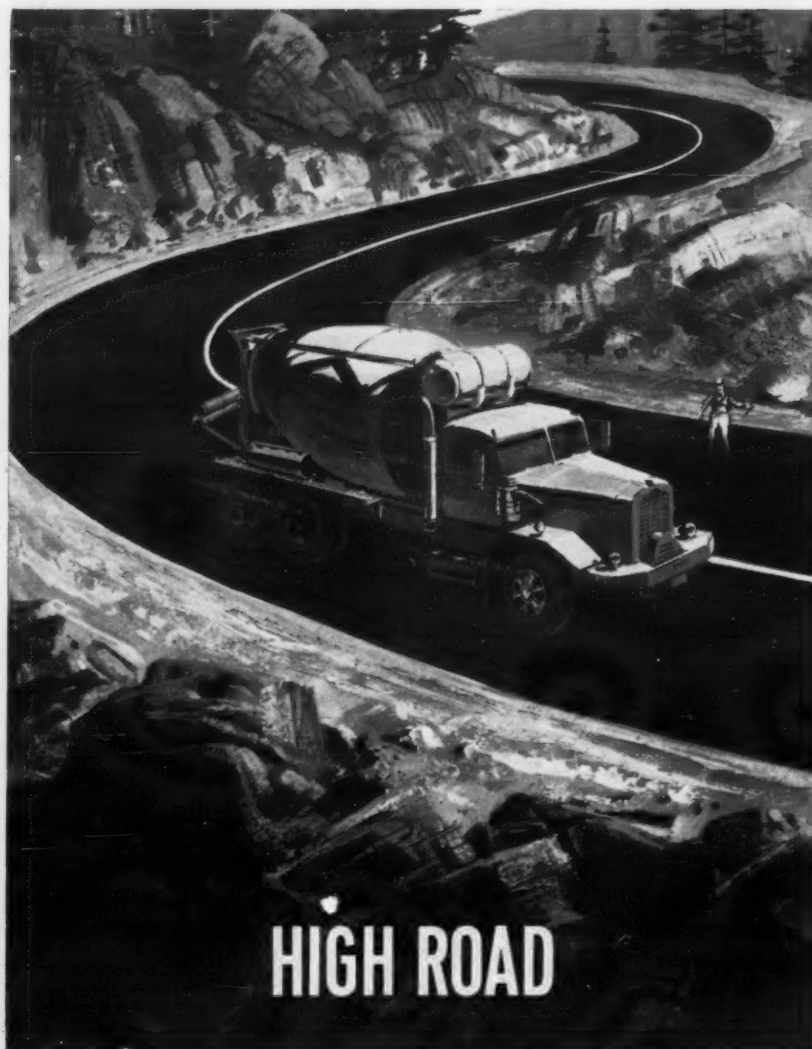
### Breadboard for Circuit Design

358



For use by design engineers, this circuit builder is composed of 108 gold-plated cells, spaced 1 inch apart in 9 horizontal rows of 12. Each of the holes has a rubber core protruding through it. Parts are held in place by pulling up the core, inserting the component pigtail and releasing the core, which firmly holds up to seven leads of varying diameters. Parts such as tube sockets or transformers may be equipped with permanent wire leads which are clipped in place. Measuring 9-1/2 by 12-1/2 inches, the cellulose-filled phenolic board is letter-number coded to facilitate transfer of the completed circuit to printed-circuit cards.

Circuit Structures Lab., Box 36, Laguna Beach, Calif.



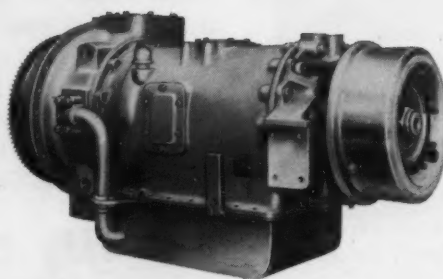
**HIGH ROAD**



**LOW**

## NOW A LIGHT-HEAVYWEIGHT TORQMATIC

Weights only 985 lbs.—measures a scant



Now you can get all the savings of a power-shift hydraulic transmission in your 18-22 ton end dumps, 13-15 yard bottom dumps, 12-15 yard scrapers, big transit mixers and heavy-duty specialized equipment in a single light-weight, compact package.

The CLBT-4460 TORQMATIC DRIVE gives the driver complete control of the speed ranges throughout the work cycle, weighs only 985 lbs., measures only 40".

With 6 speeds forward and 1 reverse, this converter-transmission team can be either remote- or direct-engine mounted. Lock-up clutch, hydraulic retarder, straight-through output and 1.42:1 step gear ratio are standard—options include four different PTO locations, transfer gear output, drum-type parking brake and 1.32:1 step gear ratio.

Want to know more about the CLBT-4460 for the crash trucks, fire trucks, snow plows, logging trucks and other equipment you're planning to buy or build? Mail the coupon today.



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40" ...fits 200-300 h.p. equipment

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**Allison** TORQMATIC  
**TORQMATIC® DRIVES**

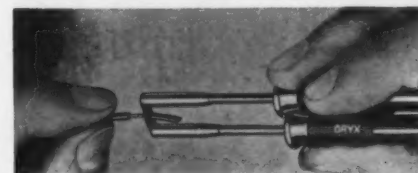
THE WORLD'S MOST COMPLETE LINE OF HYDRAULIC DRIVES

Over 980 Models used by 108 Manufacturers in  
100 to 525 H.P. Equipment.

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### Thermal Wire Stripper

359

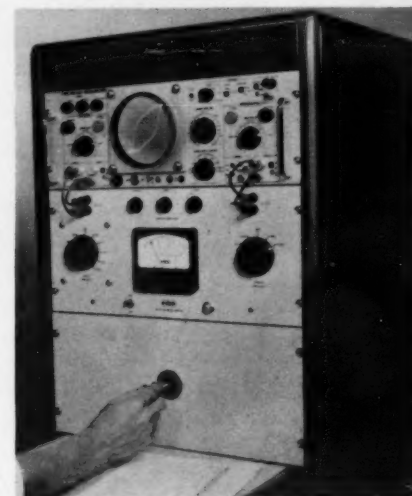


By operating at 480F, this wire stripper removes thermoplastics, PVC, nylon and rubber insulation without damage to conductors. The Model ST-6 wire stripper operates at 6v with a 3-amp a-c or d-c power supply. The device has heating elements in each arm and durable stainless-steel stripping heads. The tool measures 6 inches in length and weighs 2 oz. Its small size allows repairs in tight places where conventional bench-type wire strippers could not be used.

Oryx Co., 13804 Ventura Blvd., Sherman Oaks, Calif.

### B-H Loop Tracer

360

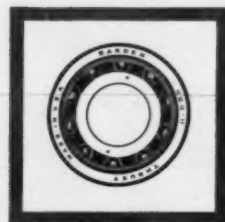


The B-H hysteresis loop of magnetic materials can be presented as a trace on an oscilloscope through the use of this device. In addition to measuring small samples of wire and other bulk materials, the "Magnetic Tracer" will evaluate samples of magnetic films as thin as 10  $\mu$  inches. A cooling system surrounds the sensing coils and overcomes temperature sensitivity, allowing the machine to be used for continuous testing. The standard model will develop a magnetic field up to 1000 oersteds and higher ranges are available on special order.

Halex, Inc., 310 E. Imperial Highway, El Segundo, Calif.



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From Barden you get fast delivery of competitively priced, performance proved instrument ball bearings from .0469" bore to 4" O. D., including a full line of miniatures.

You get quick delivery of standard sizes and types—35% of ordered items shipped same day. Large stocks of completed bearings are on hand for immediate delivery. Finished parts are ready for assembly on short notice to meet your individual specifications.

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Since 1942 major bearing users have relied on *Barden Precision* bearings for dependable performance in instruments, weapon systems, computers and other high quality equipment. West Coast customers use Barden's Los Angeles office for quotations, engineering service and quick delivery of most-in-demand sizes.

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When you order miniature, instrument, spindle or turbine bearings, let experience, performance, price, and delivery be your guide—buy Barden.

## BARDEN

### PRECISION BALL BEARINGS

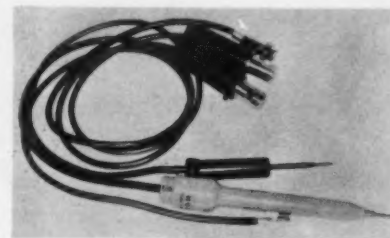
THE BARDEN CORPORATION, 230 Park Ave., Danbury, Conn. • Pioneer 3-9201 Western Office: 3850 Wilshire Blvd., Los Angeles 5, Calif. • DUNKIRK 5-0034

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## EQUIPMENT

### Pencil Welding Tool 351

Consistent pin-point welds are possible with the use of this pressure-sensing pencil welding handpiece. The probe is adjustable and fires the weld energy at preset pressures ranging from 1/2 to 5 lb. The unit is for use in high-density

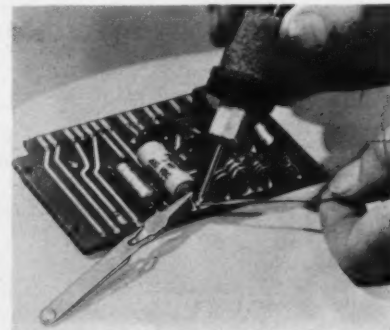


electronic component assembly and strain-gage installation. It weighs 6 oz without cables.

Hughes Aircraft Co., Vacuum Tube Products Div., 2020 Short St., Oceanside, Calif.

### Transistor Heat Sink 352

Leads on transistors may be soldered with less danger of ruining the unit by using this all-aluminum heat sink. Designed with tapered jaws for easy gripping of fine delicate wires, the No. 349 heat sink also doubles as a tweezer or a



clamp. The all-aluminum construction allows fast heat dissipation while soldering.

X-Acto Precision Tools, Inc., 48-41 Van Dam St., Long Island City 1, N.Y.

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working with  
**Du Pont Zytel<sup>®</sup>**

one of Du Pont's versatile  
engineering materials



**Fuel  
regulator  
molded of  
ZYTEL<sup>®</sup> NYLON  
RESINS**

**is lower in cost, lighter in weight, easier to install**

You might well ask, "lower", "lighter" and "easier" than *what*? The answer: *than automotive fuel-pressure regulators constructed of metal or glass and metal*. This new fuel regulator, which controls the pressure of gasoline injected into the carburetor, has three major parts precision-molded of Du Pont ZYTEL nylon resin . . . eliminating the expensive machining and finishing operations usually associated with metal regulators. Hence, cost is lower. Molded in ZYTEL, the regulator weighs only 2 oz., eliminating the need for metal clamps or other fittings. The new unit installs without adaptors to any gas line by inserting ends of the

opened line into bushings pressed into the unit.

Key to the selection of ZYTEL for this exacting application is the combination of properties offered by these resins: high mechanical strength and resistance to gasoline and petroleum products at high engine temperatures.

The Miser-Mite fuel-pressure regulator is molded by Artag Plastics Corp., Chicago, Ill., for Milemaster, Inc., Exeland, Wisconsin.

On the next page you will find more examples of how the properties of ZYTEL nylon resins are being used to improve the design and performance of products in a variety of fields.



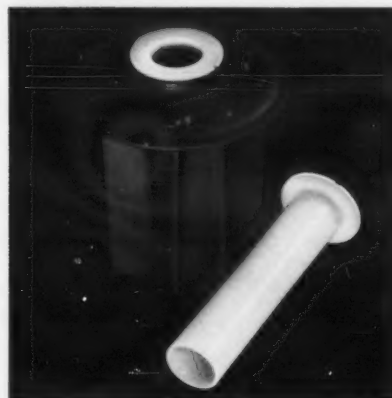
BETTER THINGS FOR BETTER LIVING  
... THROUGH CHEMISTRY

working with  
**Du Pont Zytel®**

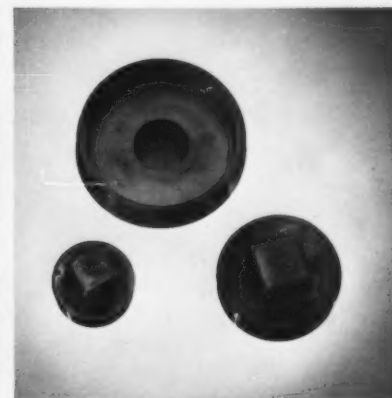
one of Du Pont's versatile  
engineering materials



**Electric motor brush holder** used in an improved electric impact wrench is a one-piece molded part of ZYTEL, providing excellent electrical insulation properties, wear resistance and high strength. Cost, including parts and assembly time, is 65% less than the three-piece fabricated brush holder assembly previously used. Molded by Amos-Burke Plastics, Inc., Syracuse, N. Y., for Chicago Pneumatic Tool Company, Utica, N. Y.



**Swivel chair hub liner** molded of ZYTEL® eliminates necessity of lubricating center spindles, maintains a wobble-free, tight fit through long periods of use. ZYTEL nylon resin was selected for its low coefficient of friction, resistance to impact and abrasion, and close molding tolerances. Molded by Nylon Products Corp., affiliated with F. J. Kirk Molding Co., Clinton, Mass., for Collier-Keyworth Company, Gardner, Mass.



**Removable cleanout plug** allows cleaning of sewage drainpipes. Molded of ZYTEL, the plug can be removed easily time after time, does not stick—because ZYTEL nylon resin resists the accumulation of mineral deposits from water. Quick, accurate injection molding eliminates need for sand casting and thread machining required by brass plugs. Coast Craft Industries, Glendale, California, for A. H. Voss Co., Los Angeles, California.

### Three useful properties of ZYTEL® NYLON: RESINS high insulation... low friction... good moldability

Depending on the particular application, different combinations of properties offered by ZYTEL nylon resins become crucial—as witness the applications discussed on this page and the preceding page. To evaluate the design opportunities offered by ZYTEL for your application, consider the entire range of properties offered by ZYTEL nylon resins, and the many different formulations of ZYTEL available. The coupon below will bring you pertinent further information.

POLYCHEMICALS DEPARTMENT



BETTER THINGS FOR BETTER LIVING  
... THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.), Dept. 4  
Room 2507Z, Nemours Building, Wilmington 98, Delaware.

Please send me: ☐ How 50 Manufacturers Used ZYTEL® Nylon  
Resins to Make Better Products  
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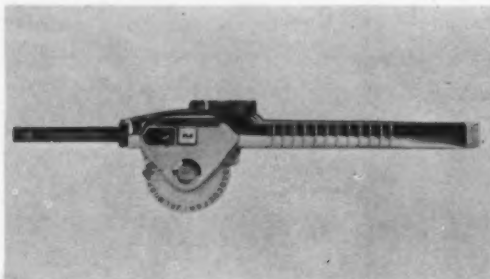
In Canada: Du Pont of Canada Limited, P.O. Box 660, Montreal, Quebec

A  
B  
C  
D

**ZYTEL®** nylon resins

one of Du Pont's versatile engineering materials

Alathon® · Delrin® · Lucite®



A complete color-coding system is possible with this hand-operated label maker. The user rotates a plastic letter-number dial to the character desired, presses the handle and the letter is embossed on a 3/8-inch colored tape in contrasting white. A builtin cut-off blade trims the finished label to exact size. The adhesive-backed vinyl tape label then may be applied to almost any surface. The tape is supplied in easy-loading magazines and is available in 10 different colors.

Dymo Industries Inc., 2950 Seventh St., Berkeley, Calif.

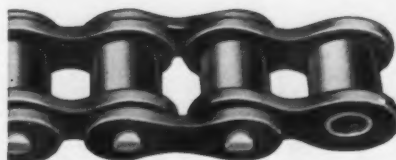
## Small-Sized Transistor Supply 354



Small enough to allow two units to be rack-mounted side by side, this power supply measures 4-1/2 inches high by 8-5/32 inches wide by 5-5/8 inches deep. Output is continuously variable from 0 to 30v d-c at up to 300 ma. Line load voltage regulation is 0.05 percent with ripple of 0.5 mv rms. Internal protection of the power supply allows continuous operation into overloads, including short circuits. Remote programming is provided at 100 ohms per volt and special terminations permit regulation to be maintained directly from the external load.

Kepeco Inc., 131-38 Sanford Ave., Flushing 52, N.Y.

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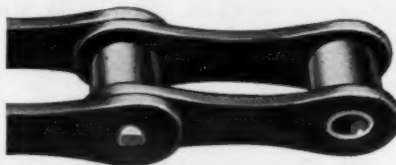
SINGLE STRAND



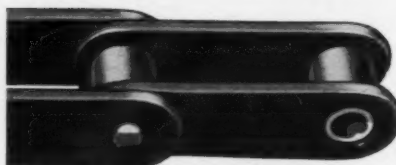
DOUBLE STRAND



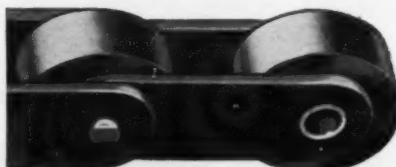
SINGLE STRAND, HEAVY SERIES



DOUBLE PITCH TRANSMISSION



DOUBLE PITCH CONVEYOR



DOUBLE PITCH CONVEYOR, LARGE ROLLERS

**CALL THE TRANSMISSIONER**—your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look under "Dodge Transmissioner" in the white pages of your telephone directory, or in the yellow pages under "Power Transmission Machinery."



**DODGE**  
of Mishawaka, Ind.

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**NO KEYSEATING!**

**NO REBORING!**

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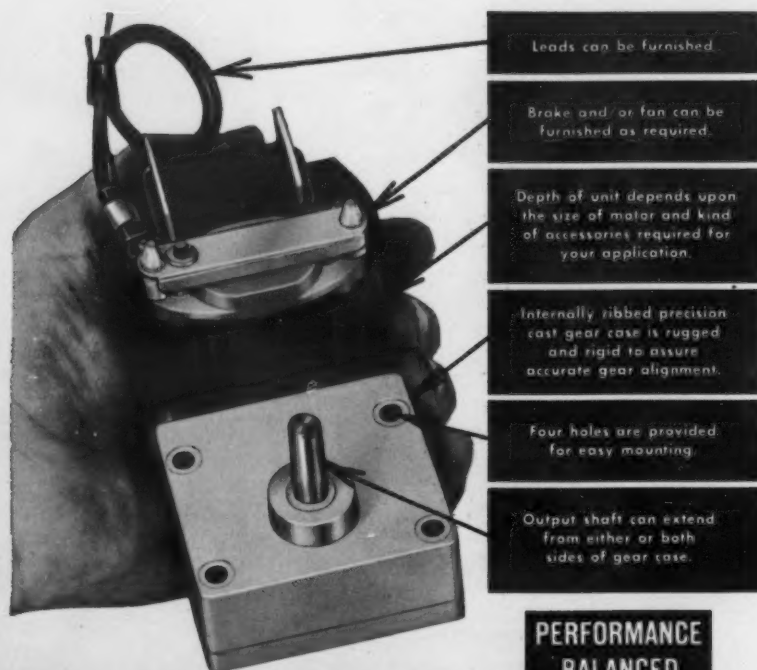
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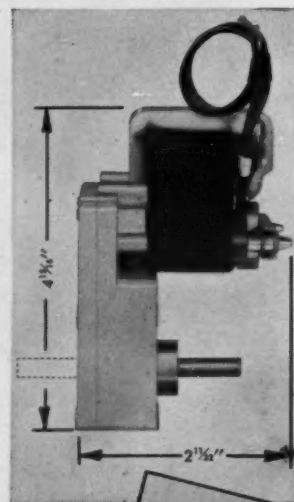
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For complete details,  
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355

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Garret Corp., 9851 Sepulveda Blvd., Los Angeles 45, Calif.



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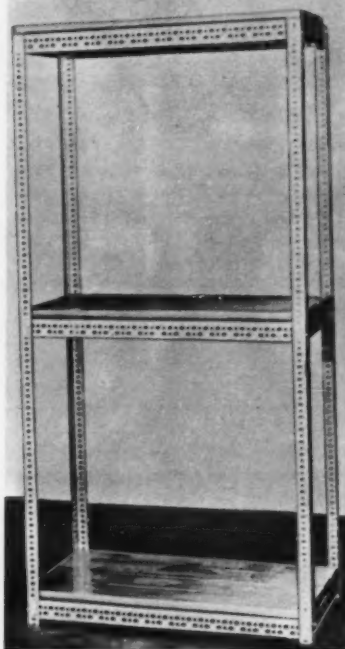
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DESIGN NEWS—NOVEMBER 10, 1961

### Quick Shelves

356

Precisely cut lengths of "Slotted Angle," with accessories, bolts, knurled nuts and instructions, facilitate the assembly of these shelves in a matter of minutes. The storage units are available in 6-, 7-, 8- and 9-ft heights, in 2-, 3- and 4-ft depths and in lengths from 36 to 60 inches in 6-inch increments. Extra shelves are also



available to span two or more complete units or to add shelves to a basic unit if needed. The "Slotted Angle" frame material also is offered in standard 10-, 12- and 15-ft lengths to allow construction of the customer's own units.

Acme Steel Co., Fabricated Materials Div., 135th St. & Perry Ave., Chicago 27, Ill.

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New Bulletin FP-62 will give you more information on the divisional product groupings. For your copy, contact the field office near you (listed in the Yellow Pages and Thomas' Register, Volume IV), or write to Bellows-Valvair, Akron 9, Ohio, Dept. DN-1161.

1200-C

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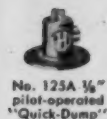
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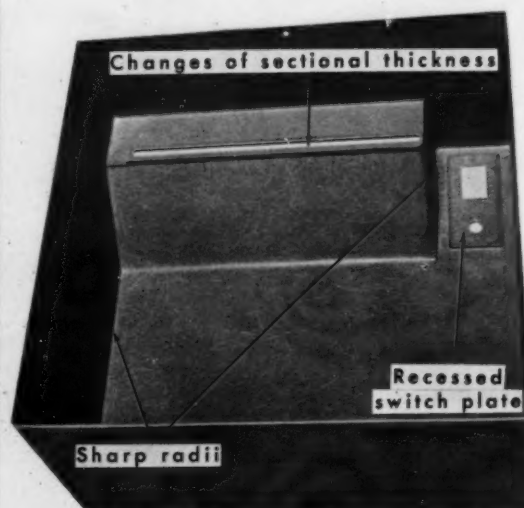
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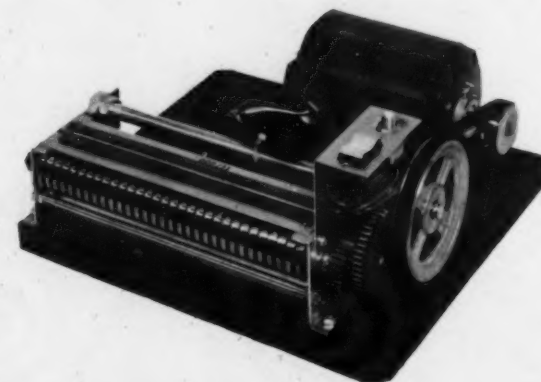
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### 'Wet Slurry' Fiber-Glass Process Allows Better Housing Design

E. J. Stefanides, Central States Editor



HOUSING is molded to close tolerance, has thickness of approximately 0.100 inch. Tolerances on wall thickness may range from  $\pm 0.010$  to  $\pm 0.005$  inch. Sharp corners retain full material strength because of uniformity of density at corners which prevents loss of strength through resin richness. Minimum allowed outside of radius is 1/16 inch, minimum inside radius is 1/32 inch. Wall thickness may be varied as needed to meet strength requirements.



DOCUMENTS are destroyed by passing between slitting rolls which tear them into uniform 1/4-inch strips. Tearing action provided by roll design obviates sharpening and other maintenance associated with cutting actions.

PAPER SHREDDER is designed for on-premises destruction of confidential documents and obsolete business records. Housing is match-metal-die-molded from preforms produced by wet slurry process. Name plates and facing of inclined surface are adhesive backed, pressure-sensitive aluminum metallized trims.





## TORQUE SEQUENCE VS. BOLT LOADS

Studies with new washer-type force gauges show how distribution of total bolt load on flanges is affected by torquing sequence, and how distribution varies with the amount of the load.

E. M. SMOLEY, Research Physicist, Armstrong Research and Development Center

The fiber-glass housing of a new business machine was designed for fabrication by the wet slurry process. The use of this process, in conjunction with matched-metal-die molding, results in a housing having design characteristics not readily attainable with other fiber-glass molding techniques. These include thinner cross-sections for material savings, sharper radii, variations in cross-sectional thickness for greater strength, and improved surface appearance and texture.

The wet slurry process is a method for production of the felted preform from which the housing is molded. The preform is built up on a perforated preform screen submerged in a water mixture containing chopped fiber-glass strands and resin additives. Water pumped out from within the screen causes the previously resin-coated strands to build up on the surface of the preform screen. Variations in the number and location of the holes in specific areas provide precise control of preform thickness and guarantee an overall uniformity in fiber density and distribution.

Precise control of thickness and fiber density allows a greater freedom in the design of the molded part. It prevents resin-richness at corners and allows sharper radii to be used without loss of strength. It also permits precise variation in cross-sectional thickness and allows closer tolerances on part thickness. This permits thinner sections to be used with thicker sections where required for additional strength, resulting in lighter weight designs and greater economy of material.

Several other factors were of importance in selection of this material and process. Their use provided a precision and economy consistent with the overall design objective and were readily adaptable to quantity production techniques. As a result, costs of the finished housing were competitive with housings produced by other plastic and metal working techniques.

This choice also allowed greater freedom of styling and offered a versatility of colors and decorative effects, thus assuring a product compatible with modern office furniture and other business machines.

This housing is used on a new, low-cost portable office machine, designed to destroy confidential papers and obsolete business records by shredding the paper into 1/4-inch strips.

The machine is designed and manufactured by the Electro-Shred Corp., Lebanon, Ohio. The housing is manufactured by the Cimastra Div., The Cincinnati Milling Machine Co., Cincinnati, Ohio.

To insure a seal on a gasketed joint, it is important not only that flange pressures be adequate but that these pressures be distributed as uniformly as possible around the flange.

One of the factors affecting distribution of flange loads is the sequence in which bolts are torqued. This prob-

The engineers used a test flange which was fitted with a new type of strain gauge called a force washer. (See Figures 1 and 2 and captions) These gauges, no larger than an ordinary washer, were placed on each bolt and wired individually to a recorder that charted the actual loads.

Separate tests were then run, with each bolt tightened to torque wrench readings of 5, 10, 15, 20, and 25 pound-feet. The bolts were tightened as shown in Figure 3.

On the basis of the original torque wrench readings, it would be assumed that the load on each bolt, and the distribution of the total load, would be about equal. Each bolt would then bear about 25% of the total load.

Our tests indicate that this is not true.

Actually, the act of tightening one bolt can raise or lower the loading on bolts already torqued.

This is demonstrated by the plot of the force gauge readings in Figure 3. For example, with all bolts torqued to five pound-feet, our force gauges indicate that, in terms of total load, 15% is on bolt #1; 5% on #2; 45% on #3; and 35% on #4.

As the initial torque level is increased, the distribution of the load becomes more equal and each bolt

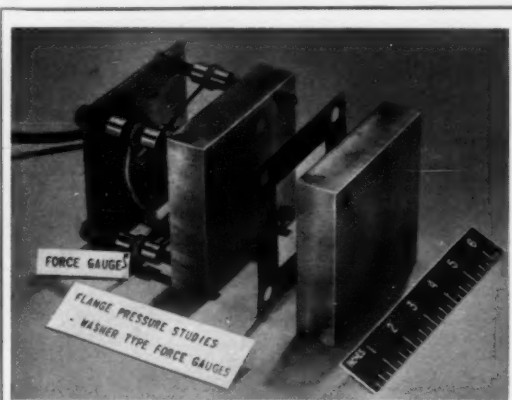


Figure 1. Breakdown photo of test flange shows how force washers were used to measure distribution of bolt loads. Gauges are between load sleeves.

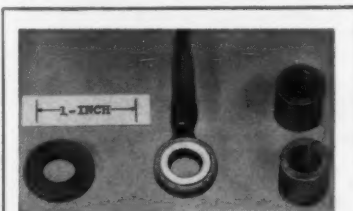
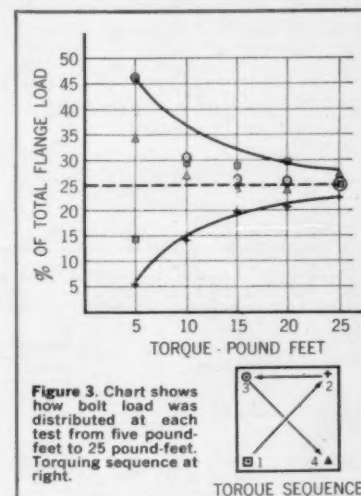


Figure 2. Washer-type force gauge compared with standard flat washer. Load sleeves at right are used to equalize load. Force gauges supplied by Lockheed Electronics Co., Avionics and Industrial Products Division, 6201 E. Randolph St., Los Angeles, Calif.



carries more of its planned share. At 25 pound-feet, each bolt is carrying about 25% of the load.

This data confirms previous findings which indicate that the best seals are obtained by using the maximum torque obtainable with a specific flange design. It also has broad practical application in the many instances where bolt torques of 15 pound-feet or less are used.

Studies on the effect of torquing sequence are part of our continuous engineering research on gasket performance. Our large library of data may already contain the answers to your specific sealing problem. We will be glad to make suggestions if you will submit details to us. Write Armstrong Cork Company, 7111 Ithaca Street, Lancaster, Pennsylvania.

**Armstrong GASKET MATERIALS**

## Beam Deflection

William Griffel, P.E., Picatinny Arsenal, Dover, N. J.

In the solution of problems in statically indeterminate structures, it is convenient to use an expression for beam deflection in terms of the extreme fiber stress on the section due to bending. Combining the moment formula

$$M = SI/C = WL/n$$

with the formula for deflection

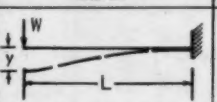
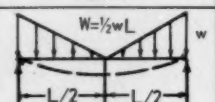
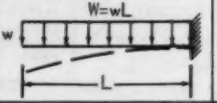
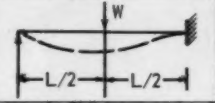
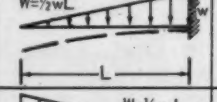
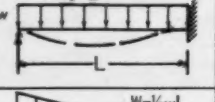
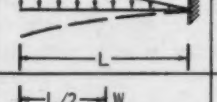
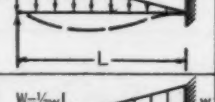
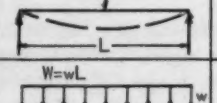
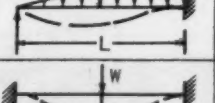
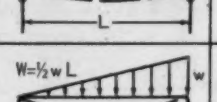
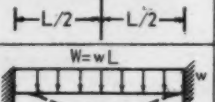
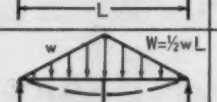
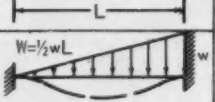


$$y = WL^3/mEI,$$

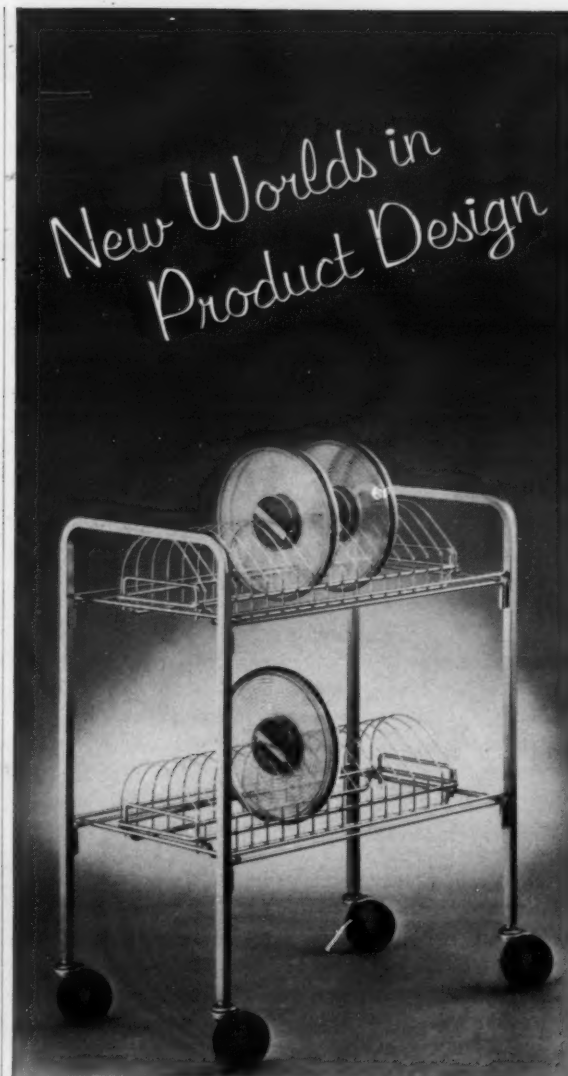
Then

$$y = SL^2/KEc$$

If  $d$  = depth of section =  $2c$ ,

$$y = 2SL^2/KEd$$

Table 1							
BEAMS OF UNIFORM CROSS-SECTION, LOADED TRANSVERSELY							
CASE NO.	LOADING & SUPPORT	BEAM	K	CASE NO.	LOADING & SUPPORT	BEAM	K
1	Cantilever end load		3	9	End supports, triangular load		8.9
2	Cantilever, uniform load		4	10	One end fixed, one end supported, center load		20.5
3	Cantilever, triangular load		5	11	One end fixed, one end supported, uniform load		13
4	Cantilever, triangular load		3.6	12	One end fixed, one end supported, uniform load		19.1
5	End supports, center load		12	13	One end fixed, one end supported, triangular load		28
6	End supports, uniform load		9.6	14	Both ends fixed, center load		24
7	End supports, triangular load		599	15	Both ends fixed, uniform load		32
8	End supports, triangular load		10	16	Both ends fixed, triangular load		38.2



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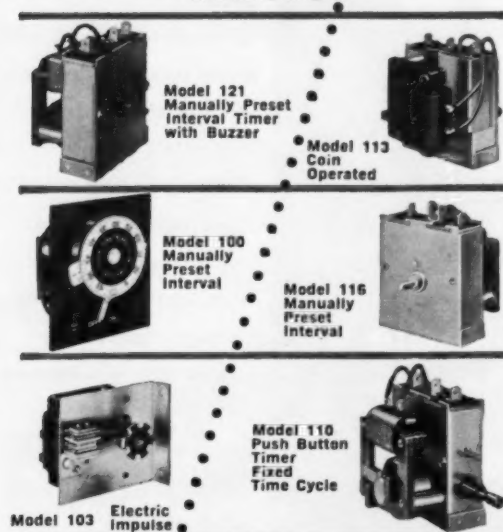
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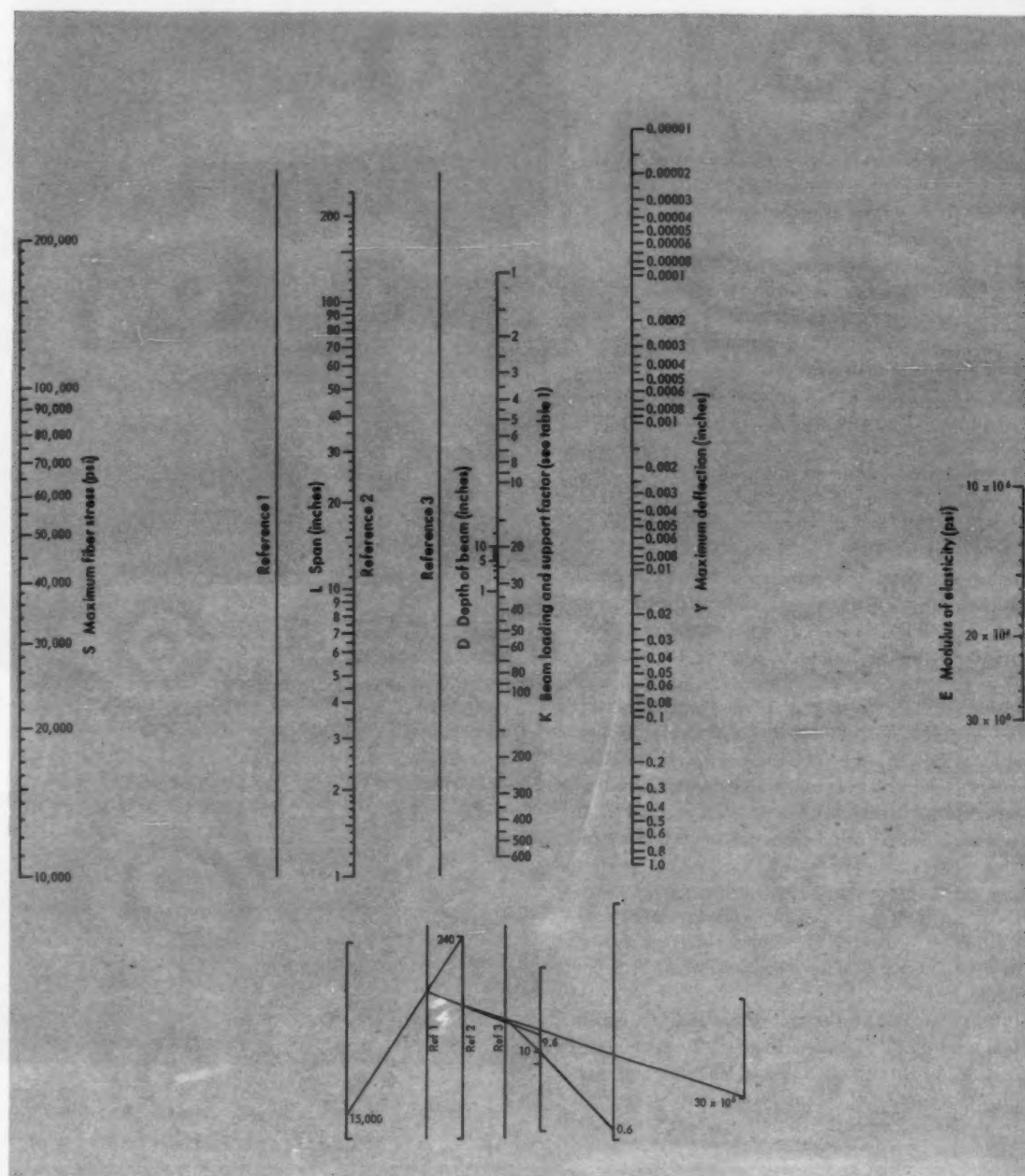
Where:

- $W$  = load, lb
- $S$  = maximum fiber stress, psi
- $L$  = span, inches
- $d$  = depth of beam, inches
- $y$  = maximum deflection, inches
- $n$  and  $m$  = constants
- $K$  =  $m/n$ , a constant which changes with loading and support condition (see Table 1).

Example: A 10-inch, 25.4-lb steel I-beam, 20 ft long, freely supports a uniform load. If the maximum

fiber stress is 15,000 psi, determine the maximum deflection in inches.

Solution: The beam is illustrated in Table 1, Case 6, for which  $K = 9.6$ . Align  $S = 15,000$  with  $L = 240$  inches, intersecting Reference line 1. Align this intersection with  $K = 9.6$ , intersecting Reference line 2. Align this intersection with  $E = 30 \times 10^6$ , intersecting Reference line 3. Align this intersection with  $d = 10$ , intersecting  $y = 0.6$  inch.





## DESIGN DATA

### Fixed Plates and Cover Plates Minimum Required Thickness

Richard Feng, Worthington Corp., Harrison, N. J.

The ASME Code of Unfired Pressure Vessels gives the following formula for calculating the minimum plate thickness, exclusive of corrosion allowance, unstayed flat heads, cover plates and blind flanges (see reference):

$$t = D\sqrt{CP/S}$$

Where:

- t = minimum required thickness of plate, exclusive of corrosion allowance (inches)
- D = diameter, or shortest span, measured as indicated in Fig. 1 (inches)
- P = design pressure or maximum allowable working pressure for existing vessels (psi)
- S = maximum allowable stress value (psi)
- C = plate coefficient depending on type of heads and covers (Fig. 1)

The nomograms, which are constructed for the coefficients "C" given in Fig. 1, will aid in the calculation of:

- (1) minimum required plate thickness, t, for given D, P and S,
- (2) allowable design pressure, P, for given t, D and S.

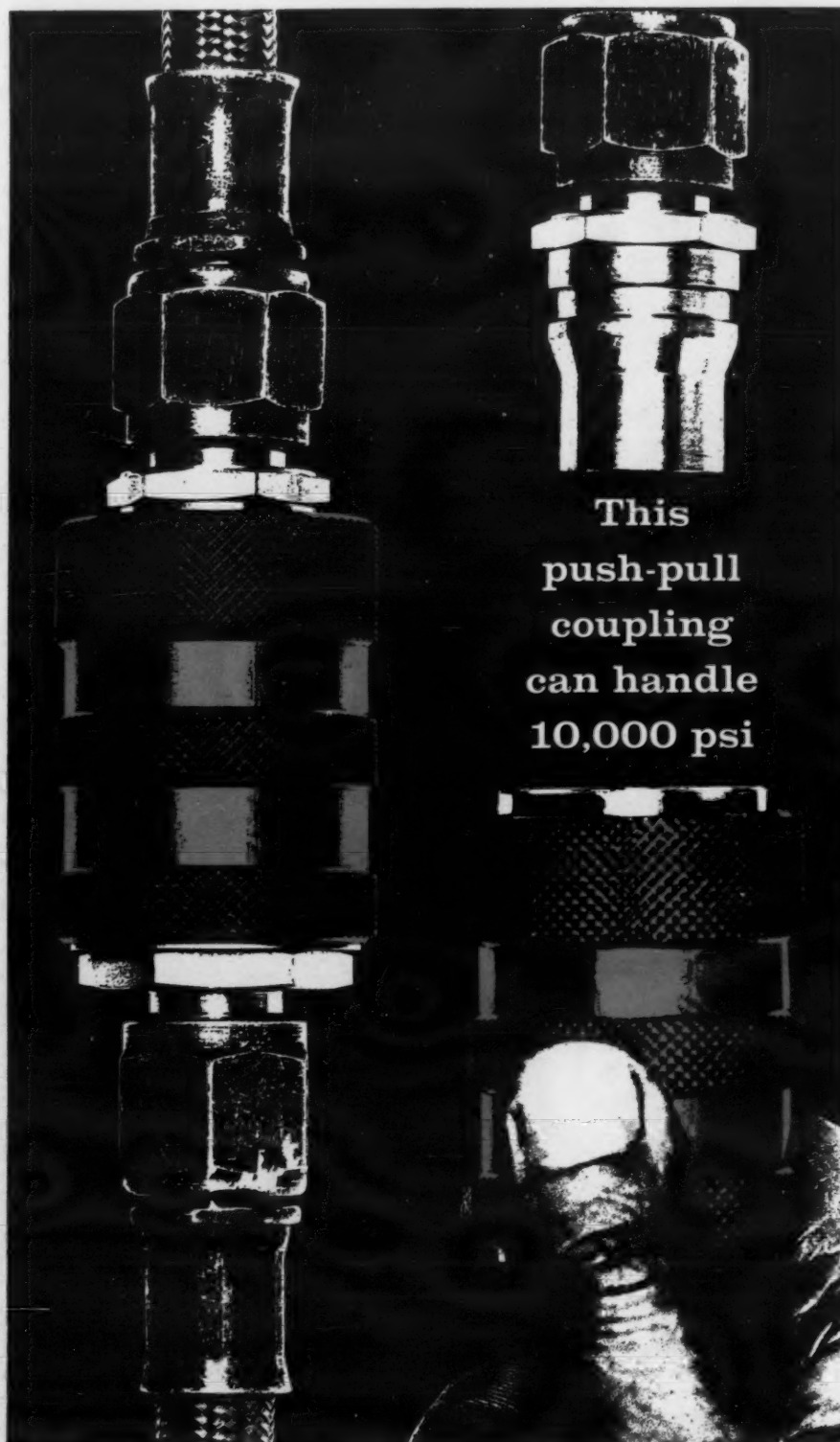
**Example 1:** Find the minimum required plate thickness exclusive of corrosion allowance for a bolted flat head if design pressure = 100 psi, diameter of bolt circle = 24 inches and allowable stress = 13,750 psi.

**Solution:** Referring to Fig. 1, the coefficient for bolted flat head is C = 0.162 (Case 1). Using nomogram I, align D = 24 with P = 100, intersecting the reference line. Align this intersection with the allowable stress S = 13,750 and read the required plate thickness t = 0.83 inch.

**Example 2:** Find the allowable design pressure P for a 1-inch-thick flat head (exclusive of corrosion) of diameter D = 36 welded as shown in Fig. 1, Case 6. The allowable stress is S = 17,500 psi.

**Solution:** For Case 6 the coefficient is C = 0.50. Use nomogram II. Align plate thickness t = 1 with allowable stress S = 17,500, intersecting the reference line. Align this intersection with D = 36 and read the design pressure P = 27 psi.

Reference: UG-34, ASME Code, 1959 Edition.



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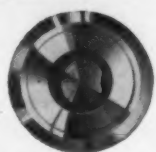
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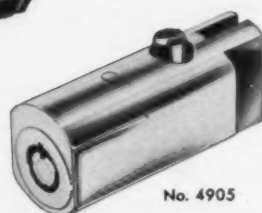
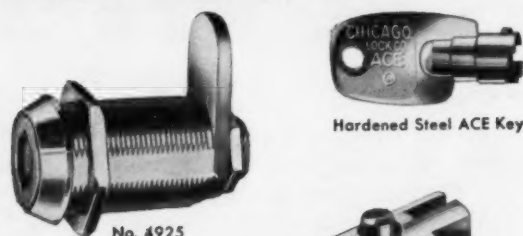
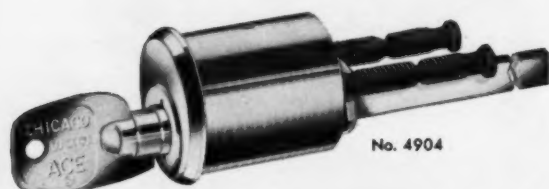
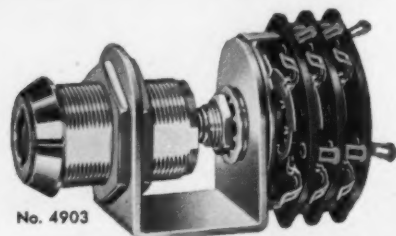
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DESIGN NEWS—NOVEMBER 10, 1961

**NEW**  
UNDERWRITERS'  
LISTED



# CHICAGO ACE<sup>®</sup> PIN TUMBLER LOCKS

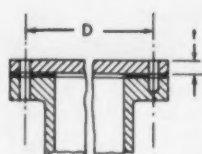


Here is the only line of locks listed by Underwriters' Laboratories. The unique ACE Locks provide the maximum in mechanical security. Over 80,000 keying combinations are possible so that you may have your own factory-registered tumbler set-up. For technical details on models available for various applications, write for Switch Lock Bulletin UB 501.

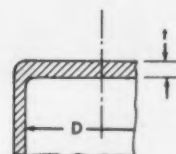
**CHICAGO LOCK CO.**

2038 N. Racine Avenue • Chicago 14, Illinois

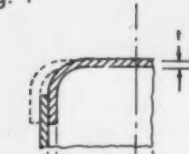
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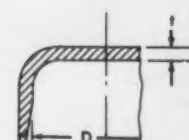
Case 1 C=0.162



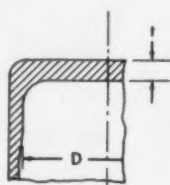
Case 2 C=0.162



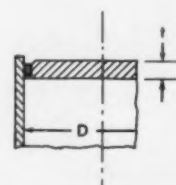
Case 3 C=0.30



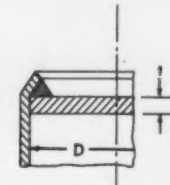
Case 4 C=0.25



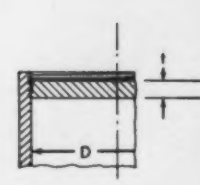
Case 5 C=0.25



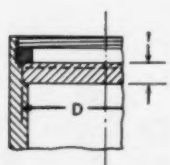
Case 6 C=0.50



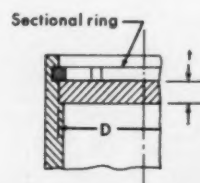
Case 7 C=0.50



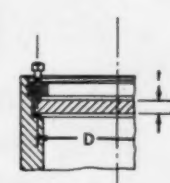
Case 8 C=0.75



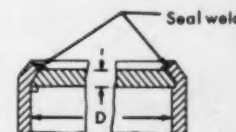
Case 9 C=30



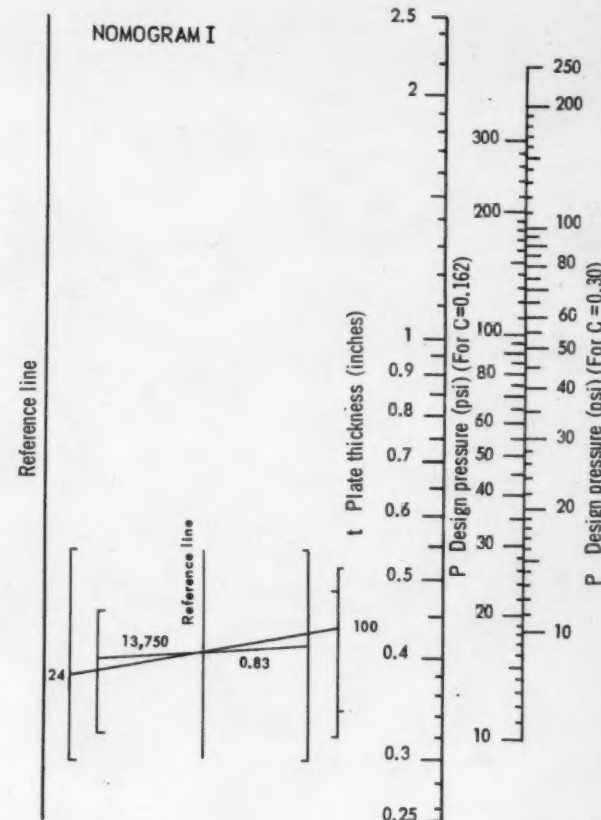
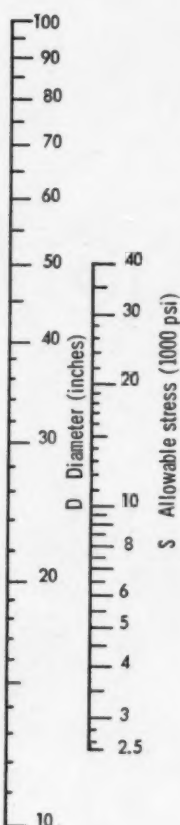
Case 10 C=0.30



Case 11 C=0.30

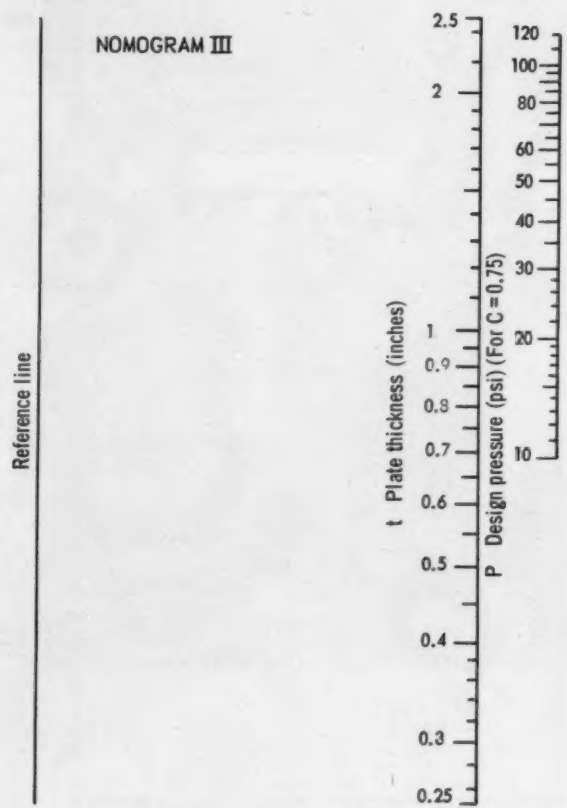
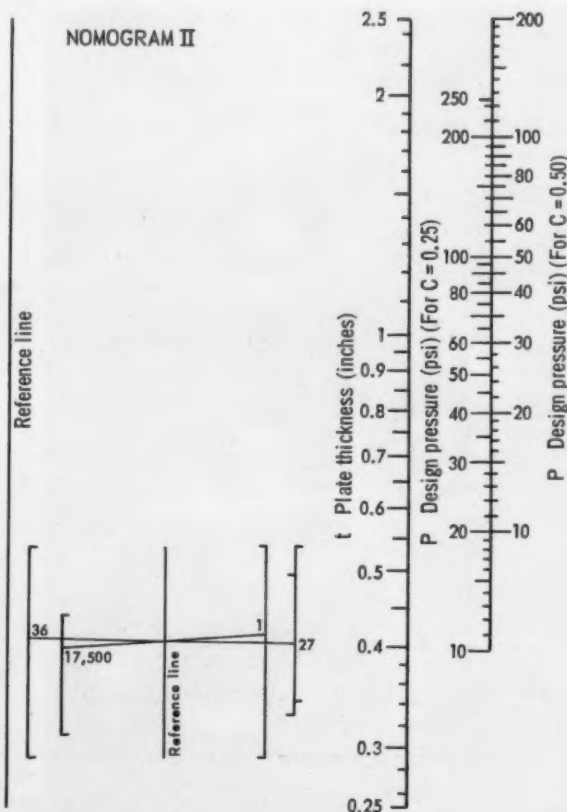
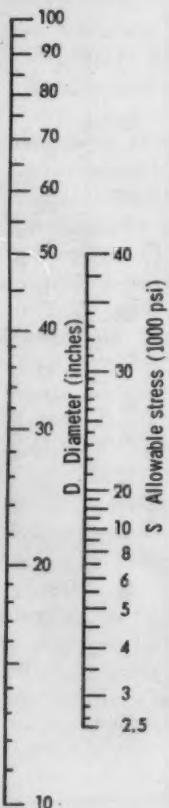
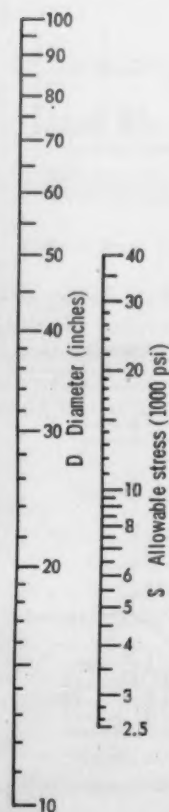


Case 12 C=0.50



(Continued on next page)

## Fixed Plates and Cover Plates . . . Cont.



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## FOR CASTINGS THAT UNDERGO HEAVY SHOCK AND HIGH STATIC LOADS



**SPECIFY**  
**PRECEDENT 71**  
**ALUMINUM CASTING ALLOYS**

### HIGH YIELD STRENGTH • HIGH SHOCK RESISTANCE

Precedent 71 A and B are high strength, shock resistant aluminum sand casting alloys which in the condition as cast and aged at room temperature, develop the highest combination of physical and mechanical properties of any such alloy now available. Precedent 71A as cast and fully aged has a yield strength of 36,000 p.s.i. As solution heat treated and aged in the T6 condition, it has a yield strength of over 40,000 p.s.i. and still has over 5% elongation. Precedent 71B as cast and fully aged has a yield strength of 32,000 p.s.i. and at the same time has 7% elongation. Precedent 71 A and B offer a combination of high yield strength and high shock resistance not found in other aluminum casting alloys.

*Write Today for Free Bulletin*

**WILLIAM F. JOBBINS INCORPORATED**



P. O. BOX 230A  
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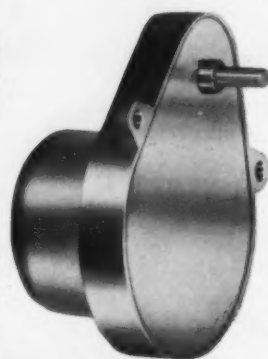
DESIGN NEWS—NOVEMBER 10, 1961





this unique  
variable  
pole arm  
development

... in the NEW  
VP III MOTOR



assures **100% STARTING  
RELIABILITY**

To build your product better... or develop a new one... choose the VP-III synchronous motor. It's the only permanent magnet motor that starts *instantly* — even when rotor poles are in dead-center position.

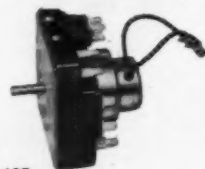
The VP-III motor's reliable starting characteristics stem from a unique, L-shaped variable pole arm. Whenever the poles of the rotor are dead-center, the field coil induces magnetism in this arm to turn the rotor.

Positive lubrication, heavy duty gear train and high output torque are added reasons why the VP-III motor helps you design better electromechanical devices. Write for full information to Dept. N.

Put greater promise in your product... specify precision Lake City timers, powered by VP-III motors for absolute reliability.



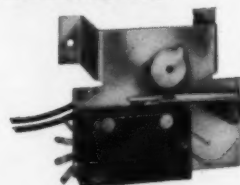
VC-300  
variable cam  
timer, with  
one to eight  
circuits.



MODEL 105:  
1-6 circuit cycling timer;  
positive-stopping design.



CD-100: compact, 1-2 circuit  
timer; dust cover optional.



GT-100: general purpose timer  
with single DPDT or SPDT switch.

**LAKE CITY, INC.**

A SUBSIDIARY OF CONTROLS COMPANY  
CRYSTAL LAKE, ILLINOIS



OF AMERICA  
LC-3-61

## Geneva Drives

W. K. Hollis, Mechanical Engineer, Aladdin Industries, Inc., Nashville, Tenn.

Formulas:

$$K^{\circ} = 360/N$$

$$\text{INDEX} = 180^{\circ} - K^{\circ}$$

$$\text{DWELL} = 180^{\circ} + K^{\circ}$$

$$R_d = R_g (\tan K^{\circ}/2)$$

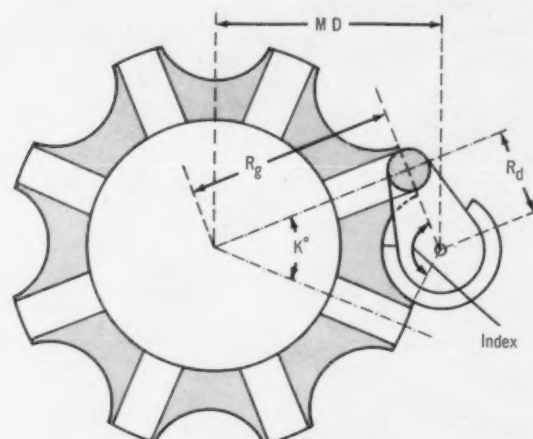
$$R_d = MD (\sin K^{\circ}/2)$$

$$R_g = R_d (\cot K^{\circ}/2)$$

$$R_g = MD (\cos K^{\circ}/2)$$

$$MD = R_g (\sec K^{\circ}/2)$$

$$MD = R_d (\csc K^{\circ}/2)$$



Number of Stations	K degrees	INDEX degrees	INDEX percent	DWELL degrees	DWELL percent	$R_d$		$R_g$		MD	
3	120	60	16.67	300	83.5	1.7320 $R_g$	0.86603 MD	0.57735 $R_d$	0.5000 MD	2.0000 $R_g$	1.1547 $R_d$
4	90	90	25	270	75	1.0000 $R_g$	0.70711 MD	1.0000 $R_d$	0.70711 MD	1.4142 $R_g$	1.4142 $R_d$
5	72	108	30	252	70	0.72654 $R_g$	0.58778 MD	1.3764 $R_d$	0.80902 MD	1.2361 $R_g$	1.7013 $R_d$
6	60	120	33.33	240	66.67	0.57735 $R_g$	0.50000 MD	1.7320 $R_d$	0.86603 MD	1.1547 $R_g$	2.0000 $R_d$
7	51° 27'	128° 33'	35.71	231° 27'	64.29	0.48180 $R_g$	0.43405 MD	2.0755 $R_d$	0.90089 MD	1.1100 $R_g$	2.3039 $R_d$
8	45	135	37.5	225	62.5	0.41421 $R_g$	0.38268 MD	2.4142 $R_d$	0.92388 MD	1.0824 $R_g$	2.6131 $R_d$
9	40	140	38.89	220	61.11	0.36397 $R_g$	0.34202 MD	2.7475 $R_d$	0.93969 MD	1.0642 $R_g$	2.9238 $R_d$
10	36	144	40	216	60	0.32492 $R_g$	0.30902 MD	3.0777 $R_d$	0.95106 MD	1.0515 $R_g$	3.2361 $R_d$
12	30	150	41.67	210	58.33	0.26795 $R_g$	0.25882 MD	3.7320 $R_d$	0.96592 MD	1.0353 $R_g$	3.8637 $R_d$
14	25° 43'	154° 17'	42.86	205° 43'	57.14	0.22826 $R_g$	0.22251 MD	4.3808 $R_d$	0.97492 MD	1.0257 $R_g$	4.4935 $R_d$
15	24	156	43.33	204	56.67	0.21256 $R_g$	0.20791 MD	4.7046 $R_d$	0.97815 MD	1.0223 $R_g$	4.8097 $R_d$
16	22° 30'	157° 30'	43.75	202° 30'	56.25	0.19891 $R_g$	0.19509 MD	5.0273 $R_d$	0.98078 MD	1.0196 $R_g$	5.1258 $R_d$
18	20	160	44.44	200	55.56	0.17633 $R_g$	0.17365 MD	5.6713 $R_d$	0.98481 MD	1.0154 $R_g$	5.7588 $R_d$
20	18	162	45	198	55	0.15838 $R_g$	0.15643 MD	6.3137 $R_d$	0.98769 MD	1.0125 $R_g$	6.3924 $R_d$
22	16° 22'	163° 38'	45.45	196° 22'	54.55	0.14380 $R_g$	0.14234 MD	6.9538 $R_d$	0.98982 MD	1.0103 $R_g$	7.0254 $R_d$
24	15	165	45.83	195	54.17	0.13165 $R_g$	0.13053 MD	7.5957 $R_d$	0.99144 MD	1.0086 $R_g$	7.6613 $R_d$
30	12	168	46.67	192	53.33	0.10510 $R_g$	0.10453 MD	9.5144 $R_d$	0.99452 MD	1.0055 $R_g$	9.5668 $R_d$

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## geared for big savings on motor-driven machinery

**LINK-BELT MOTOR COUPLINGS  
GIVE YOU TOP GEARED COUPLING  
PERFORMANCE IN A LIGHT-  
WEIGHT, LOW-COST DESIGN!**

Savings begin the minute you buy Link-Belt type MC Motor Couplings. They're priced low among high-quality flexible couplings. This, plus geared efficiency, makes them your best choice for pumps, compressors, generators and similar motor-driven equipment.

Geared design assures high capacity and durability . . . torque transmitting parts are accurately machined from cold-rolled steel. And compensation for both angular and parallel misalignment is FREE—i.e., without imposing loads on shafts and bearings.

Link-Belt Motor Couplings are available off-the-shelf for shafts up to 2½".

**LINK-BELT**  
COUPLINGS

**LINK-BELT COMPANY:** Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Warehouses, District Sales Offices and Stock Carrying Distributors in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarborough (Toronto 13); South Africa, Springs; Switzerland, Geneva. Representatives Throughout the World.

15, 618



**FOLDER 2975** will tell you all about the Link-Belt Motor Coupling and what it will do for you. Also, it will introduce to you the new Link-Belt Spacer Adapter which will greatly reduce time and maintenance costs. For a copy, contact your nearest Link-Belt office listed under couplings in the yellow pages of your telephone directory.

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## NEW LITERATURE

To obtain copies of numbered literature . . . circle appropriate number on Reader Service card.

### Printed-Circuit Flow Charts 451

This set of four flow charts indicates the step-by-step operation used to produce printed circuits by the etched-circuit, the solder-plated circuit, the photo-resist and the plated-circuit processes. The charts indicate the operations where the manufacturer's products can be used to advantage. London Chemical Co., Inc., 1533 N. 31st Ave., Melrose Park, Ill.

### Welding Symbols Chart 452

This chart provides basic weld symbols and their location significance; typical welding symbols; supplementary symbols; location of elements of a welding symbol, and basic joints. Punched for three-ring binding, the chart is printed on 8-1/2- by 11-inch heavy stock and should be a valuable reference in design, development or manufacturing where welding is used. Lenco, Inc., 350 W. Adams St., Jackson, Mo.

### Engraved Steel Marking Tools 453

Describes a wide range of engraved steel lettering tools available for indenting, embossing and blind stamping. A flexible transparent lettering chart (which can be placed directly over part or print to illustrate mark) is included in the 14-page brochure. Complete specifications are provided as well as a spectrum of marking processes for industrial part, component, product and package identification. Consolidated Stamp Mfg. Co., Inc., Markomation Div., 56 Church St., Spring Valley, N. Y.

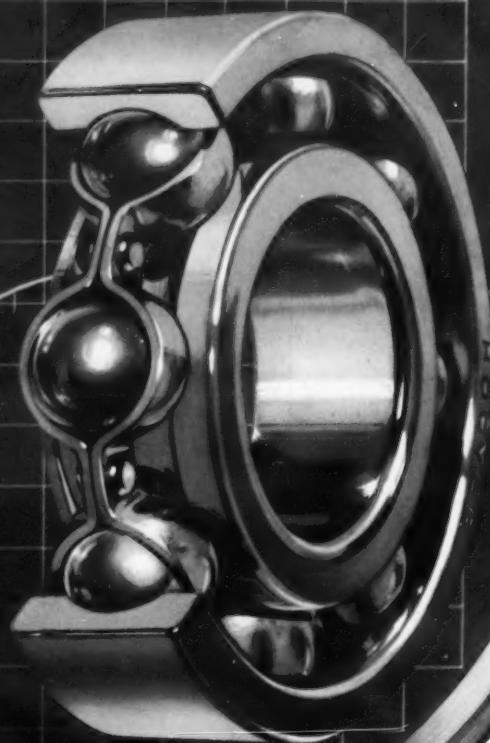
### Electronic Parts and Products 454

A 592-page catalog lists industrial electronic products at factory prices. Items include semiconductors, connectors, capacitors, resistors, relays, plugs, transformers, special-purpose tubes, meters, cables, nuvistors, thermistors, counters, motors and power supplies. New with the catalog is a 13-page directory of semiconductors. An extensive line of high-fidelity equipment is featured, including tuners and receivers with built-in multiplex circuits for reception of recently developed stereo FM broadcasts. Tape recorders and accessories, stereophonic records and tape recordings, and public address systems also are featured. Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.

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# hoover quality bearings

... HARDLY A WHISPER



Nuclear submarines like the SKIPJACK are designed to carry out underwater missions in utmost silence. That is why the hushed quietness of Hoover Quality ball bearings makes them ideal for critical applications on this and many other types of equipment.

Hushed quietness in a bearing is a promise of excellent quality, superior performance and long life.

And it's no coincidence that Hoover bearings are exceptionally quiet. Hoover Honed bearing raceways are super smooth, superbly finished. Micro-Velvet balls are spherically accurate within millionths of an inch and surface finished to microscopic perfection. These precision components work together in perfect harmony. We, at Hoover, know because every Hoover Quality bearing is checked electronically before it is shipped.

*Hoover Honed and Micro-Velvet are Hoover Trademarks*

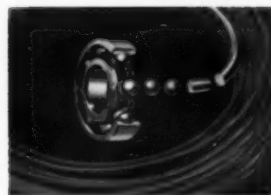
## hoover

**BALL AND BEARING COMPANY**

5400 South State Road, Ann Arbor, Michigan

Zone Sales	8581 South Chicago Ave., Chicago 17, Illinois
Offices and	290 Lodi Street, Hackensack, New Jersey
Warehouses	2020 South Figueroa, Los Angeles 7, California

**hoover CONTROLS hoover quality FROM START TO FINISH**



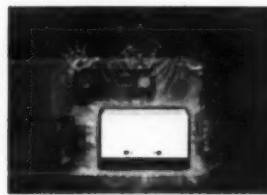
High quality wire from which balls are made is produced by Hoover's Cuyahoga Steel and Wire Division.



Hoover Micro-Velvet Balls are made of the finest of chrome alloy steel. Sphericity is measured in millionths of an inch.



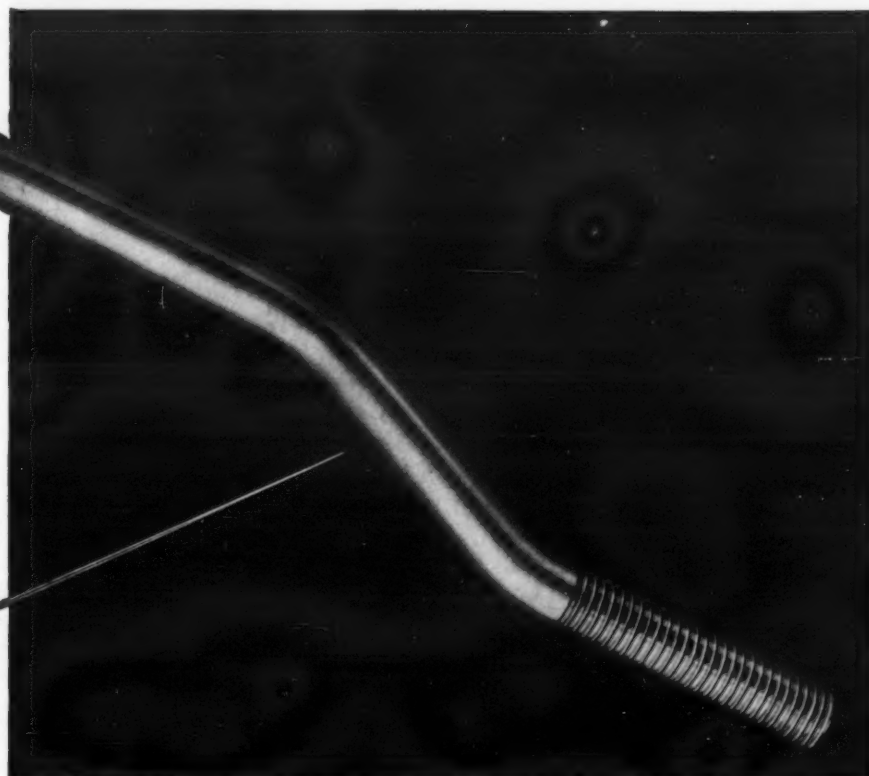
It's easier to strike a match on plate glass than on the smooth finish of a Hoover Honed bearing raceway.



Hoover quality control methods include non-destructive electronic inspection of bearing components.



NAT'S  
quick facts  
about  
Fasteners...



## Shining example...of big things in **specials** by National

This is a large offset eyebolt, shown here big as life. We designed and made it to order for one of our customers.

To begin with, it shows that we can and do make some sizable things in the way of cold headed Special Products.

But there's more here than seems to meet the eye.

When our customer brought us this eyebolt, he had been having it made as a forged eye welded to a machined bolt, with a cut thread.

We gave it some thought, then made it... with a difference. We cold formed it in one piece, and rolled the thread... turning out a stronger, more practical, and more efficient part, and lopping off costs all along the line.

And there's the real point... what we

really mean when we mention doing BIG things in Specials, at National... better parts, large or small, at lower cost, by cold heading and designing for profit.

We do it right along, and we can very likely do it for you, too. Want to find out? Just drop a note to Special Products Service, at our address\*. And if you just happen to have a Special problem, tell us all about it—and let us help.

\*It will bring you this illustrated booklet "Bring your Special Problems to National", 16 pages about Specials as National sees them.



The National Screw & Mfg. Company • Cleveland 4, Ohio

California Division, The National Screw & Mfg. Company • 3423 South Garfield Avenue, Los Angeles 22, California

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#### Transistor Heat Dissipator Test Report 455

Describes tests on a new type of transistor heat dissipator. Samples of various universal power transistor heat dissipators were evaluated for their heat-dissipating characteristics and their ability to withstand severe environmental conditions. Report No. 172-A includes a list of equipment used in the test, test procedures and results. Test results are given in a series of 15 tables. The 48-page report contains 18 graphs showing case and junction temperatures for various transistors used in the test with the transistor heat dissipators. International Electronic Research Corp., IERC Div., 135 W. Magnolia Blvd., Burbank, Calif.

#### Fiber Optics Report

456

This 12-page report is intended as an aid to scientists and engineers in understanding the general properties, and practical problems involved, when fiber optics are incorporated into a device. Applications of fiber optics given include cathode-ray tubes, image intensifiers, numerical readout devices and probes. Properties discussed include numerical aperture, lens field angle versus numerical aperture, nongeometric image distortion, random coupling, surface reflections, fiber shape, area efficiency and depth of focus. A table provides available fiber optic combinations. Chicago Aerial Industries, Inc., 550 W. Northwest Hwy., Barrington, Ill.

#### Conveyor Belt Engineering

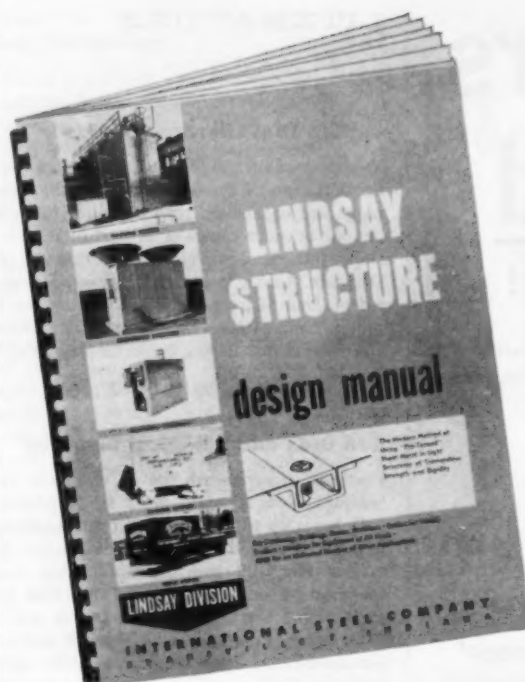
457

Bulletin 175, 24 pages, contains useful charts, graphs and photographs illustrating sections on: information required for horsepower calculation and a new condensed horsepower formula; speed and idler factors and how to determine them; drive factors; horsepower required to overcome pulley friction, and estimated average belt weights (lb/ft). Another section illustrates a typical conveyor problem and shows how to calculate belting, idlers, horsepower in a given situation, complete with diagram. Charts show how to determine horsepower for acceleration, how to select proper belt construction, recommended minimum pulley diameters and maximum allowable working tension for various types of belting in pounds per inch of belt width. Hewitt-Robins, 666 Glenbrook Rd., Stamford, Conn.

#### Pump Motor Instruction Manual

458

Form F-2042 Instruction Manual covers Type HU oil-lubricated motors. The 28-page brochure is divided into three main sections: installation, operation, and maintenance and repair. Detailed installation instructions are provided on mounting, oil-fill, electrical connection, mechanical connection and use of upthrust protection. Operating instructions cover first-time starting and stopping checklist, shutdown protection and lubrication directions. A table of recommended oils lists the manufacturer and trade name of each. A two-page "troubleshooting" chart gives symptoms, with probable cause and remedy for motor failing to start, failing to come up to speed, running hot, vibrating or running noisily. In the maintenance and repair section, disassembly and reassembly steps and charts, inspection techniques and a numbered parts reference list are provided. U. S. Electrical Motors, Inc., Box 2058 Terminal Annex, Los Angeles 34, Calif.

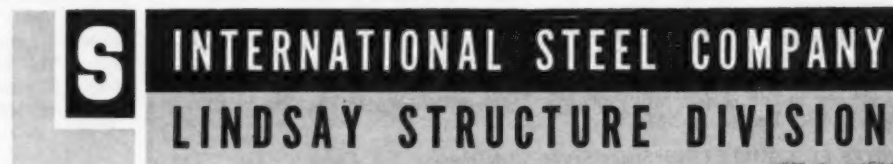


# FREE LINDSAY STRUCTURE *Design* MANUAL

- descriptive information
- technical data and explanations
- instructions for specification

The Modern Method of Using "Pre-Tensed" Sheet Metal  
in Light Structures of Tremendous Strength and Rigidity.  
For Producing: Buildings, Rooms, Partitions • Bodies for Trucks,  
Trailers • Housings for Equipment of All Kinds •  
AND for an Unlimited Number of Other Applications

You'll find the answer to any questions you may have about Lindsay Structure in this comprehensive 68-page manual. This unique metal structure is widely used in the construction of enclosures, housings, cabinets, trucks and trailers of all sizes and shapes — for use indoors or out, mobile or stationary, industrial, military and commercial applications, including shielded structures. Lindsay Structure is extremely flexible to design requirements, and is available in a wide range of metals. Ideal for pilot models and production runs, high-strength, low-weight ratios of Lindsay Structure components can readily solve your enclosure problems. Write today to get your copy of this new manual right away!



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# Special Motors are Standard AT PEERLESS ELECTRIC!

Need a special motor? Our knowledge may aid in reducing the engineering time. We are the exclusive supplier to many manufacturers for motors with unusual operating conditions and duty requirements. Write us your needs!



## DRIP-PROOF (open type)

Completely protected against dripping liquids and falling particles.



## DIRECT CURRENT

High starting torque, good overload capacity and high electrical efficiency. For rough usage.

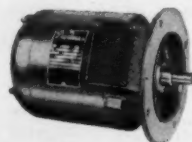


## EXPLOSION-PROOF TORQUE MOTOR WITH BRAKE

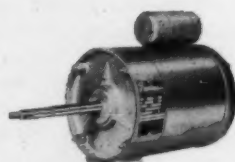


## TEPC and EXPLOSION-PROOF

External fan draws cool air across motor toward driven machine.



## WEATHER-TIGHT SPECIAL FLANGE



## SPECIAL FLANGE REVERSING HOIST MOTOR, SINGLE PHASE

**ENGINEERING DATA:** Special mountings. Various modifications—special shaft features; paint and varnish treatments, Class A, B, F, H insulation. Peerless builds to standards and specifications of JIC, AIEE (including AIEE No. 45 Marine Duty), ABS, Federal and Military.

**WRITE FOR BULLETINS:** Space-Saver, SP-1; Torque, T-1; Complete Line, SDA-155. Peerless Electric Division, H. K. Porter Company, Inc., W. Market Street, Warren, Ohio.

PEERLESS ELECTRIC DIVISION

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## LITERATURE

### Cutting Tool Literature Guide

459

This four-page guide lists more than 30 brochures, booklets, catalogs and articles available on request. A reply card is enclosed with the guide to facilitate ordering one or more copies of desired literature. Form C-48 helps provide complete information on cutting tool literature. Among publications listed are articles on "The Art of Tool Sharpening" and "Getting the Most out of Milling" and catalogs on end mills, cutters, carbide tools and twist drills. Brown & Sharpe Mfg. Co., Providence 1, R. I.

### Rod Ends and Spherical Bearings

460

Features an expanded line of rod ends and spherical bearings. New standard items are large-sized rod ends with bores up to 2 inches and control-rod assemblies in six sizes. Stud rod ends also are included. The 12-page catalog No. 102 provides application and complete specification information for Types CM and CF rod ends, Types CMS and CFS rod ends with stud, Type CB spherical bearings, and Types CR and CRR control-rod assemblies. Split Ballbearing, Div. of MPB, Inc., Lebanon, N. H.

### Self-Centering Aligner Rolls

461

Theory of operation of Lorig Aligner Type II self-centering rolls is detailed in brochure ADUCO 78019-61, 11 pages. The rolls are used in tension bridges, in handling delicate strip, as pinch rolls, idler rolls and as pulleys in conveyors and other belted systems. Theory of operation of the rubber-covered rolls includes their capability of positive centering and tracking of strip-like materials under all operating conditions. U. S. Steel Corp., Room 6385, 525 William Penn Pl., Pittsburgh 30, Pa.

### Explosion-Proof A-C Motors

462

Bulletin 1000 CD describes a line of integral-horsepower explosion-proof a-c motors ranging from 1 through 5 hp. In addition to illustrating the electrical and design features of the motors, the two-page bulletin lists principal dimensions for the various NEMA frame sizes. Motors include single-phase capacitor-start induction-run types with overload thermal protection as an optional feature, and polyphase motors of squirrel-cage design. The Leland Ohio Electric Co., subsidiary of Howell Electric Motors Co., 16315 W. Seven Mile Rd., Detroit 35, Mich.

### Chain Lubrication Manual

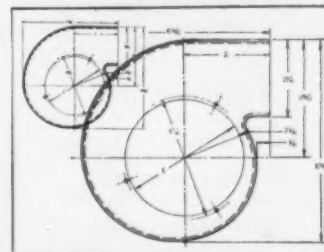
463

Bulletin 1800, eight pages, gives general recommendations and suggestions for lubrication of power drive chains as well as conveyor and elevator chains. A table of useful engineering data, including nomenclature, is provided. Specific methods of chain oiling are described, ranging from manual brush-type lubricators to completely automatic systems, spray oiling and forced-feed lubrication for high-speed chain drives. Lubrication ideas for high-temperature chains and chain cleaning are discussed. Oil-Rite Corp., 2331 Waldo Blvd., Manitowoc, Wis.

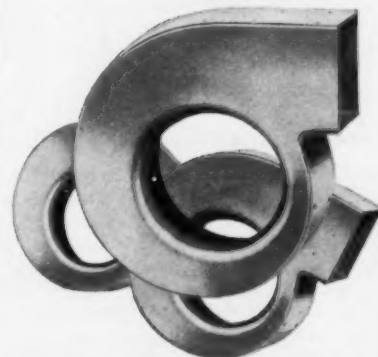
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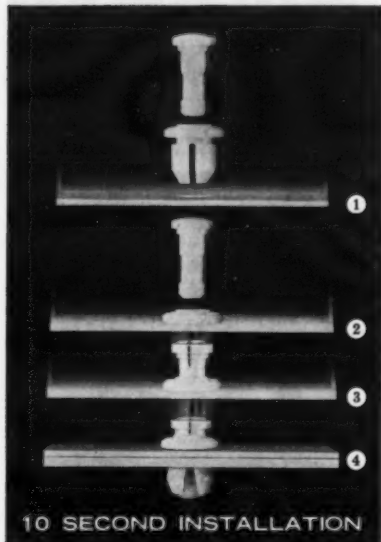
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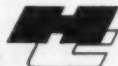
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## Developments in Science and Technology

464

The first issue of a monthly publication covers significant developments in science and technology. Vol. 1, No. 1 of the "Northrop Technical Digest" includes articles on a new ballistic camera, a high-speed drill, a pocket-sized computer and space-age ballistics. Northrop Corp., 9744 Wilshire Blvd., Beverly Hills, Calif.

## How to Specify Crystal-Controlled Oscillators

465

This four-page booklet contains all the requirements necessary to specify oscillators. An oscillator selector chart covers the manufacturer's line of oscillators in frequency ranges from 25 cps to 20 mc. A second chart lists oscillators for ultralow frequency applications. Monitor Products Co., Inc., 815 Fremont Ave., South Pasadena, Calif.

## Stainless-Steel Condenser Tubing Data

466

This 12-page booklet gives details of the use of stainless-steel tubing in condensers. Historical background, performance data, applications in various types of water and fabrication of the tubes are included. Photographs show stainless-steel condenser tubing in use and charts give comparison of average performance of 88-10-2 brass alloy and Type 304 stainless steel. Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, Pa.

## Miniature Precision Instrument Clamps

467

This 40-page pocket-sized catalog gives diagrams of specifications and OEM list prices for more than 150 different types of miniature instrument clamps. Intended as a guide for design engineers, the book is divided into 10 clamp categories, and parts listed are available from stock in both prototype and production quantities. Sterling Instrument, Div. of Designatronics, Inc., 17 Matinecock Ave., Port Washington, N. Y.

## Self-Damping Structural Material

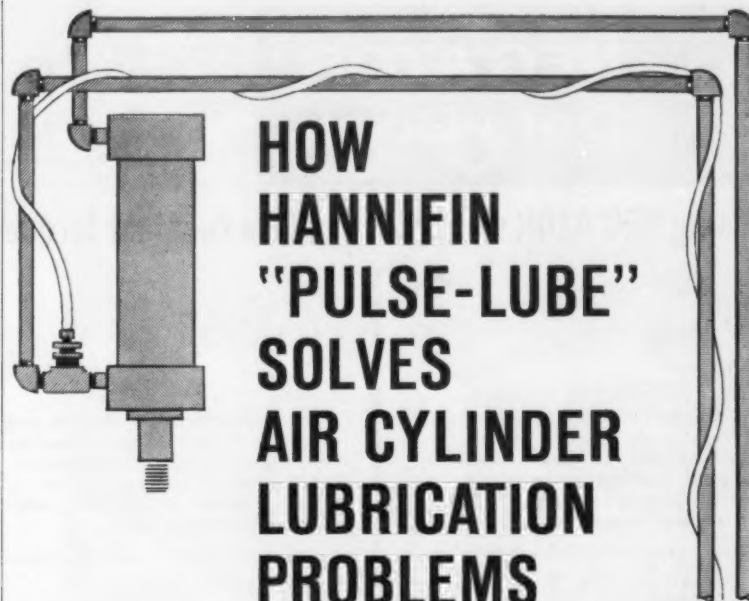
468

Bulletin No. 719 describes damped laminates for control of structural resonant response. Advantages of standard and custom-engineered "Dyna-damp" structures are detailed and basic considerations in design and selection of protection systems to combat structural fatigue, component malfunction and low reliability are explained. Technical information is provided on various structural forms and shapes and printed-circuit boards. Illustrations show specific applications in the aircraft, missile and electronics fields. Lord Mfg. Co., Erie, Pa.

## Light Metals Data

469

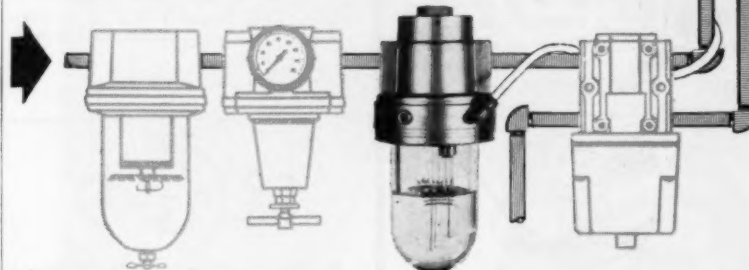
Characteristics and properties of light metals, including magnesium, aluminum and titanium. Comparative values for various metals are listed to assist in selecting the right metal. The 44 pages of design data include a chart of metal weight comparisons; a weight calculator for magnesium, aluminum and steel; a comparative properties chart; tensile modulus of elasticity curves; comparative stiffness curves, and a chart of magnesium alloy properties. Brooks & Perkins, Inc., 1950 W. Fort St., Detroit 16, Mich.



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If the cylinder is uphill from the lubricator, the air gets there, but the oil doesn't. The same thing happens "on the level" when it's a long way from your control valve to your cylinder. The oil gets only part way when the cylinder strokes, then gets blasted out the exhaust port of the valve on the return stroke. Cylinders that cycle rapidly on very short strokes, like the cylinders on gun welders, are particularly difficult to lubricate. Almost equally difficult are extremely slow stroke applications and installations where cycling is infrequent.

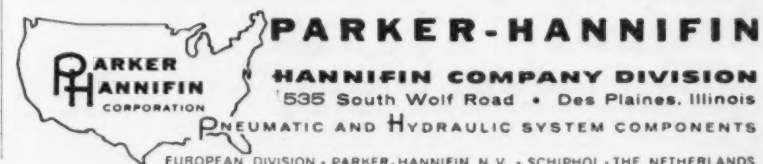
New "Pulse Lube" is Hannifin's answer to all these problems. One of these units, when added to a standard "Crown" lubricator as shown above, will deliver oil in a solid stream, apart from the main air flow. This oil can be piped any distance and put

back into the air stream at any point. The amount of oil delivered is almost infinitely adjustable. As a matter of fact, as many as four Pulse Lube units can be installed in a single "Crown" lubricator and each may be adjusted differently.

In addition, the normal operation of the "Crown" lubricator need not be interfered with. In the typical installation shown above, for instance, the "Crown" lubricator would be adjusted very "lean" so as to supply just enough airborne oil to lubricate the valve. Meanwhile, the Pulse Lube unit is set to supply the exact amount of oil the cylinder needs, without wasting any oil at the valve exhaust port, so it pays for itself in the oil it saves.

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# the NEG'ATOR Data Book

HUNTER  
Spirals in Springs

3.  
MECHANICAL  
MOTORS

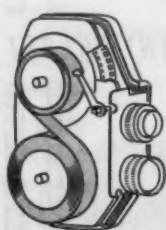
## Using NEG'ATOR springs to produce constant torque



1. The NEG'ATOR spring is a strip of spring steel formed into a prestressed coil. It resists uncoiling with a uniform pull—provides a truly constant-force spring of practically any length.



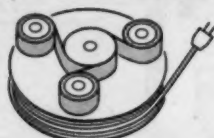
2. By reverse winding the free end around a second, larger drum, we can utilize the tendency of the material to recur to its preset curvature to make a powerful, long-running NEG'ATOR motor.



3. Thus, the NEG'ATOR motor releases maximum useful energy at constant-torque output from full wind to run down. Related components can be greatly simplified because there is no exaggerated torque peak.



4. In counterbalancing, very long vertical travel is possible from a compact NEG'ATOR unit concealed overhead, or even in the moving unit.



5. Reeling in long cords or retracting cable-connected loads is another NEG'ATOR function made possible by its great length, smooth action and constant-force properties.



6. As an anti-backlash device, a NEG'ATOR motor ensures immediate response without lag. Constant-torque load can be applied over slight movement or over many, many turns.

7. Six stocked models of NEG'ATOR motors are available to designers for test or assembly purposes. These models provide cable tensions of 3/4, 1, 2, 3, 4 and 5 lbs.



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■ Movie cameras, valve operators, recording instruments, satellite recorders, timers, X-ray apparatus, lighting fixtures, appliance cord retrievers, and other familiar products use NEG'ATOR motors, reels and counterbalances. Write for details.

The NEG'ATOR spring is a development of Hunter Spring Company.

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Niagara Filters • United States Gauge • Rahm Instruments • Lamb Electric Co. • Hunter Spring Co. • Glaser-Steers Corp.

## LITERATURE

To obtain copies of literature without Reader-Service number . . . write to company on your letterhead, mentioning DESIGN NEWS.

### Circular Slide Rule

This sizing-factor calculator provides one-setting solution of basic temperature-pressure and specific-gravity equations involved in rotameter sizing. The calculator consists of two circular slide rules—one for solving liquid-service equations and the other for gas- and steam-service equations. The units are mounted on a three-hole punched sheet of heavy plastic-coated board for insertion in personal reference files, or the sheet can be used as a wall chart. The back of the calculator lists specific gravities of common gases and rotameter-float materials. Useful pressure, volume, weight, area and length conversion tables are provided. The calculator may be obtained by sending \$1 (check or money order) to Brooks Instrument Co., 407 W. Vine St., Hatfield 6, Pa.

### Emergency Lighting Handbook

This hardbound handbook covers installation considerations, equipment specifications and maintenance requirements for emergency lighting. Designed to provide basic information on the problem of emergency lighting to consultants, engineers and architects, the handbook details reasons for emergency lighting, probability of power, legal considerations, installation design factors and wiring requirements. Diagrams show typical installations, types of equipment commercially available, exit lighting and maintenance requirements. Copies of the handbook at \$2 each may be ordered from Electric Cord Co., Handbook Dept., 432 Plane St., Newark 2, N. J.

### Industrial Electronic Equipment

More than 300 pages of information on industrial electronic equipment, components and accessories are available in catalog form. Intended for industrial users of electronic equipment and components, the catalog also lists audio components and kits, public-address systems and accessories, radio control equipment, test equipment, batteries, chargers and rectifiers. An industrial tube cross-reference is included and material is indexed by manufacturer and product. Copies are available by writing on company letterhead to Radio & Electronic Parts Corp., 3235 Prospect Ave., Cleveland 15, Ohio.

### Contamination Control of Liquid Rocket-Propulsion Systems

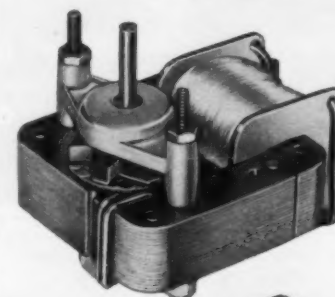
This revised edition contains control procedures and methods for determining and assuring cleanliness of liquid rocket-propulsion systems. The document represents combined efforts of the Guided Missile Council and the Propulsion Technical Committee of the Aerospace Industries Assn., the Army Ballistic Missile Agency, the National Aeronautics and Space Administration, the San Bernardino Air Materiel Command-USAF, Aerojet-General Corp., Convair-Astronautics, Douglas Aircraft Co., The Martin Co., North American Aviation, Inc., Space Technology Laboratories, Thiokol Chemical Corp. and the United Aircraft Corp. A copy of the handbook is available by writing to Aerospace Industries Assn., 610 Shoreham Bldg., Washington 5, D. C., remitting \$1.

## GENERAL INDUSTRIES

# SMOOTH POWER

## AC MOTORS

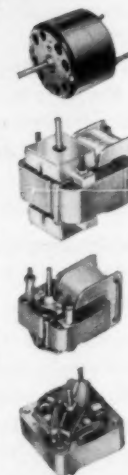
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### Metal Technology

This index to Soviet translations currently available covers diverse phases of metal technology. Included are more than 300 titles from 10 Russian technical journals. The booklet incorporates the complete tables of contents for "Tsvetnye Metally" ("Nonferrous Metals"), January through December 1960. The index is available without charge on request on company letterhead to Mr. I. Flohr, Primary Sources, 11 Bleecker St., New York 12, N. Y.

### Alumina Ceramics Standards

A 12-page publication provides basic knowledge and information about the production, design and effective use of ceramic materials and parts. Much of the material in this manual has not been published previously. Special sections cover test methods, design fundamentals, resistance to nuclear radiation and quality assurance standards. A copy of the standards may be obtained for \$1 from the Alumina Ceramic Manufacturers Assn., 53 Park Pl., New York 7, N. Y.

### Reference Materials Listing

The AMA Management Bookshelf 1961-1962 contains the latest listing of reference materials that serve as a source of information for business and industry. New available books, reports, studies, periodicals, films and filmstrips, reprints and binders are described with prices listed for each. Copies of this listing are available on request from the Publications Business Dept., American Management Assn., 1515 Broadway, New York 36, N. Y.

### Diaphragm-Design Data

Bulletin No. 50A lists approximately 1200 standard sizes of rolling diaphragms, in bore sizes from 0.31 to 12.17 inches, for strokes from 0.020 to 14.98 inches. Operating characteristics are given for each of the diaphragms. Tables give diaphragm class, cylinder bore, piston diameter, effective-pressure area, height, total maximum "half-stroke" and side-wall thickness. Drawings identify five standard classes according to mounting method. The eight-page bulletin is free on letterhead request to Bellofram Corp., Blanchard Rd., Burlington, Mass.

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SKF Industries Inc., Philadelphia 32, Pa.

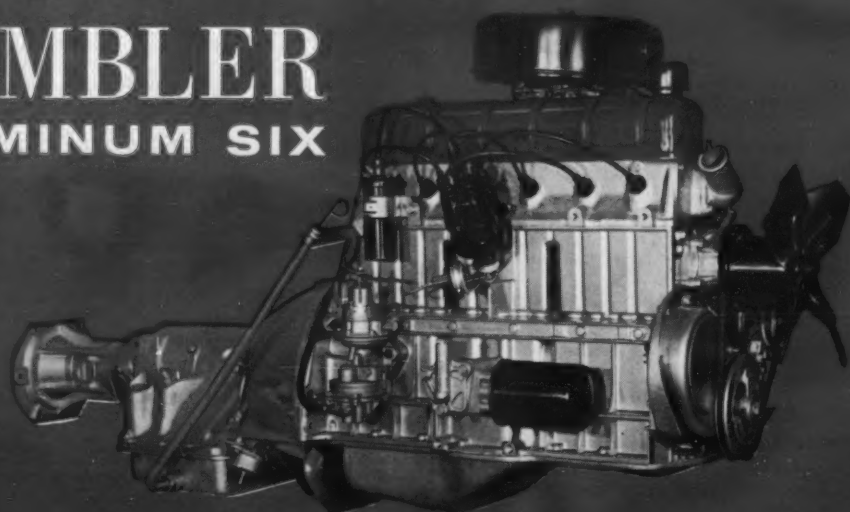
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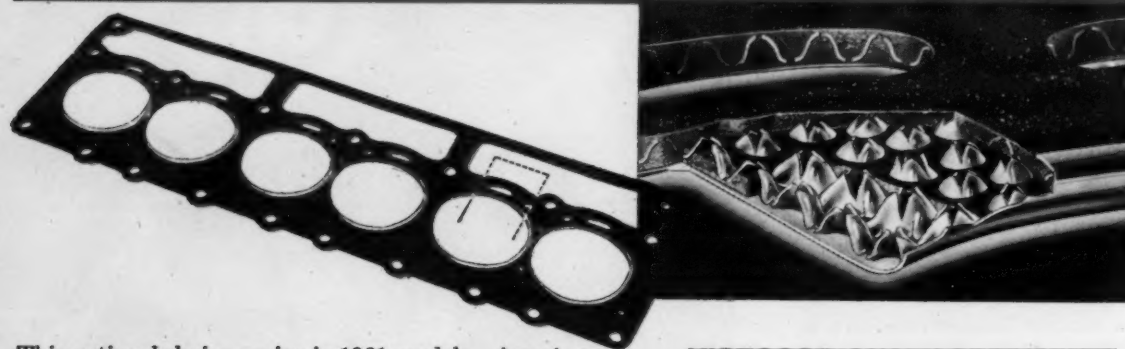
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\*Synthetic rubber-asbestos sheet packing



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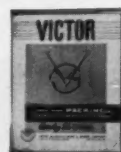
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## TECHNICAL PAPERS

### Fuel Cells A Basic and Realistic Approach

Dr. Manuel Shaw,  
The Electric Autolite Co., Toledo, Ohio

The fuel cell, it has been said, will be the energy-producing plant in large power stations; it will power electric motor cars, tractors, lawn mowers, portable equipment, satellites, space ships and golf buggies. All this will be done silently and without any fumes. And as an added bonus it will do all these things with a much greater efficiency than hitherto obtainable.

Some of the more daring writers have suggested that certain problems still remain to be solved before the golden era of the fuel cell will dawn. This last statement can be likened somewhat to the fine print in a legal document. As is often the case with glamorous subjects, too much emphasis has been placed on the proposed uses of fuel cells, and too little has been said about the real problems existing now that make the difference between dreams and reality.

So that the problems may be better appreciated by those who have a practical interest in fuel cells, this paper has as its theme a realistic look at the future of fuel cell application. To best do this, some basic understanding of fuel cells is required.

### Basic Fuel Cell

A fuel cell is an electrochemical device by which the energy from fuel combustion is converted directly into electrical energy, bypassing the intermediate steps of thermal and mechanical conversion. Because the chain of conversion from chemical to thermal to mechanical and finally to

### TYPICAL FUEL CELL

(CROSS-SECTION VIEW)

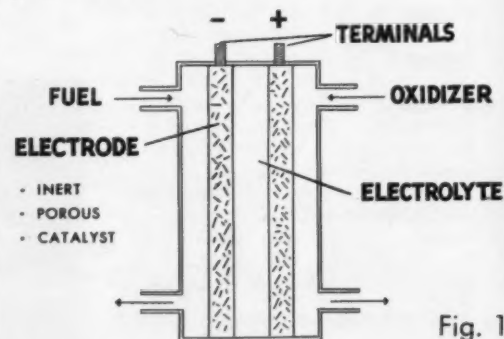
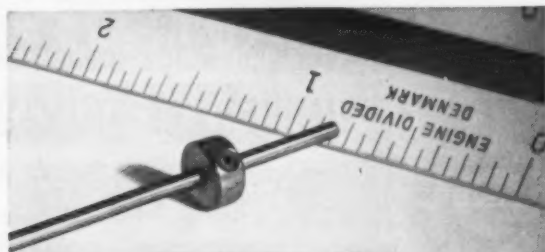


Fig. 1

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## MAGNIFICATION OF PORE (SCHEMATIC)

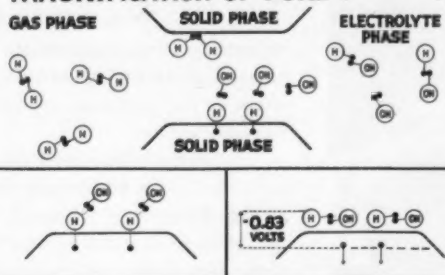


Fig. 2  $H_2 + 2 OH^- \rightarrow 2 H_2O + 2 e^-$

electrical energy is considerably shortened, and because the Carnot (an ideal cycle of four reversible changes in the physical condition of a substance) limitation based on the difference in temperatures between heat source and heat sink is avoided, much greater efficiencies can be obtained via fuel-cell conversion.

The principle underlying any combustion reaction is the same in the fuel cell as it is in a heat engine. That is, any combustion reaction involves a transfer of electrons from the fuel molecules (which are thereby oxidized) to the oxidizer molecules (which are thereby reduced). In a heat engine, molecules of both reactants are intimately mixed so that the electrons pass directly from fuel molecules to oxidizer molecules.

The fuel cell is simply a device for keeping the fuel molecules separate from the oxidizer molecules but permitting the transfer of electrons by a separate metallic path which serves as the load circuit in any power application. A schematic diagram of a fuel cell is shown in Fig. 1.

The fuel cell is in fact an electrochemical battery similar to an automobile storage battery on discharge. One chief difference exists. In a typical battery the active material is incorporated in the electrodes themselves, whereas in the fuel cell the active materials, fuel and oxidant, are fed continuously into the cell as energy is required. The fuel-cell electrodes are inert and serve as a meeting place for fuel or oxidant and electrolyte as well as a pickup for electrons. Their porosity is such that a large surface area is made available for adsorption of the gases. Catalysts are incorporated into the electrodes to facilitate the adsorption.

(Continued on next page)

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# ROPER PUMPS

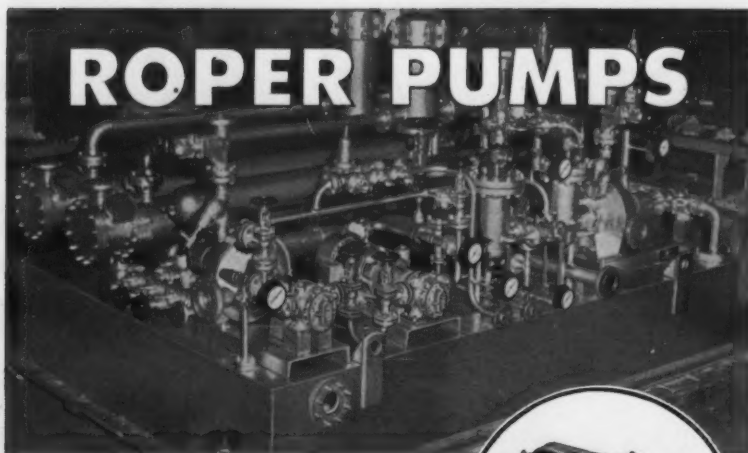


Photo courtesy The Engineer Co.

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SERIES H

## Fuel Cells . . . Cont.

### Hydrogen-Oxygen Fuel Cell

The hydrogen-oxygen fuel cell is the most successful fuel cell to date. This is because hydrogen has a high electrochemical activity. Electrons are removed easily from adsorbed hydrogen molecules. This fuel cell predates the lead-acid storage battery which itself is over 100 years old. The process of electrochemical combustion, or in other words, the mechanism by which a fuel cell produces electricity, is best understood by examining the processes occurring in the hydrogen-oxygen fuel cell.

### The Hydrogen Electrode

Fig. 2 shows a schematic representation of a single pore in the fuel electrode. The hydrogen molecules in the gas phase are shown each as two hydrogen atoms joined by a bond formed by a pair of electrons (small solid circles). The electrolyte phase consists of water molecules H-OH and hydroxyl ions -OH. The process of hydrogen adsorption on the solid phase followed by decomposition of the molecule into individual atoms is shown in the upper portion of the drawing. Two -OH ions also are shown as approaching the adsorbed H atoms.

The lower left-hand portion of the figure indicates the formation of a bond between the -OH ion and the H atom forming a water molecule, and removal of the hydrogen electron which passes into the solid phase. The theoretical potential of the hydrogen electrode is -0.83v. Shown also is the equation for the net reaction—one hydrogen molecule combines with two -OH ions to form two molecules of water with the release of two electrons ( $e^-$ ).

### The Oxygen Electrode

Processes involved at the oxygen electrode are shown in Fig. 3. Oxygen molecules are adsorbed at the solid phase from which each molecule removes two electrons. The resulting oxygen

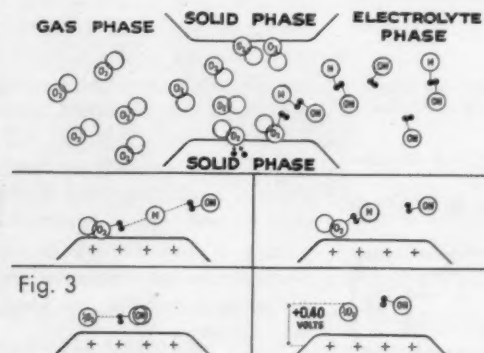


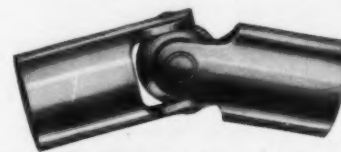
Fig. 3

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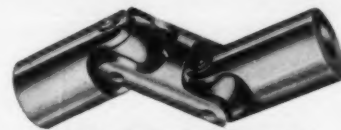
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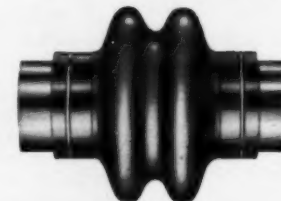
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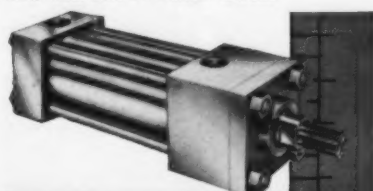
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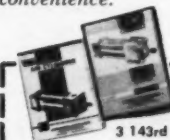
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ion forms a bond with a hydrogen ion from a water molecule, resulting in a perhydroxyl ion ( $-O_2H$ ) and a hydroxyl ion ( $-OH$ ). The  $-O_2H$  ion then decomposes into an oxygen atom and a second  $-OH$  ion. The theoretical potential of the oxygen electrode is +0.43v.

### Total Cell Reaction

The individual electrode reactions and the total cell reaction are shown in Fig. 4. The theoretical cell voltage is 1.23v.

### Electrode Potential and Current

Fig. 5 represents a plot of the individual electrode potential against current drawn through the cell. The theoretical potential of 1.23v is possible only at open circuit. If the cell is allowed to discharge so that a net current is obtained, the potential of the fuel electrode will become more positive, and that of the oxidant electrode more negative, so that a smaller net cell potential results.

The loss of available potential is given by  $\eta$ , the so-called polarization voltage.  $\eta$  represents the sum total of all energy-dissipating phenomena inherent in the cell itself. If work is to be obtained in finite time, one has to live with  $\eta$ , at least to some extent.

For a practical cell then, the maximum available energy is given by  $\Delta G = nF(E - \eta)$ , where  $\Delta G$  is the free energy change,  $n$  is the number of electrons involved in the electrochemical reaction,  $F$  is a constant equal to 26.8 amp-hr, and  $E$  is the theoretical potential. When an efficiency value of a fuel cell is quoted, it is usually (or should be) the free energy efficiency which is given. This is the ratio of the actual voltage obtained to that theoretically possible. Again, since the polarization voltage is a function of the current density, quoting efficiencies without defining the load current density (amps per sq ft, ASF) is meaningless and can be misleading.

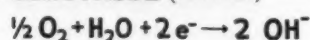
## ELECTRODE REACTIONS

### FUEL ELECTRODE (NEGATIVES)



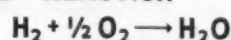
-0.83  
VOLTS

### AIR ELECTRODE (POSITIVES)



+0.40  
VOLTS

### CELL REACTION



1.23  
VOLTS  
+0.40  
VOLTS  
-0.83  
VOLTS

Fig. 4

(Continued on next page)

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### Fuel Cells . . . Cont.

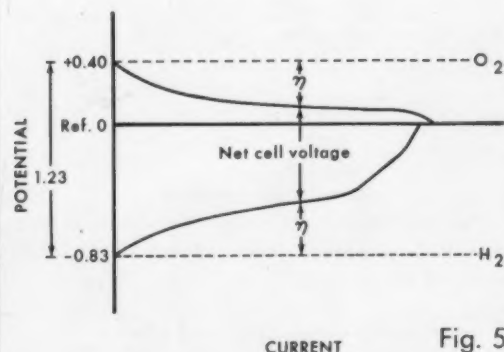


Fig. 5

### Fuel-Cell Output

Since the power output of a fuel cell depends primarily on the existence of  $\eta$ , this function warrants a closer look. There are essentially three types of polarization: activation, concentration and ohmic. Electrochemical oxidation of a fuel involves chemisorption of the gas as molecules or atoms, and removal of the electrons from the adsorbed atoms. This involves breaking of the molecular bonds and formation of new bonds between the fuel atoms and those of the catalyst. These latter bonds then must be broken and somehow, either simultaneously or not, electrons are released and the charged fuel combines with electrolyte ions to form a product. Energy is required to bring all this about. In simpler terms, a certain energy of activation is required to permit the reaction to occur. This energy must be subtracted from the theoretically maximum available. The net current density bears an exponential relationship with the activation polarization voltage. Studying the conditions by which this relationship is affected will permit the electrochemist to lessen this energy loss. Choice of proper catalysts is necessary to do this.

### Hydrocarbon Fuels

Although the hydrogen fuel cell is the most developed, several disadvantages are associated with the use of hydrogen as a fuel. These include difficulty of handling, transport and hazard factors, as well as cost. Considerable effort has been expended in developing cells which utilize hydrocarbons. The most successful of these to date involve high-temperature operation (900 to 1500F). The high temperature is required to crack the hydrocarbon to an electrochemically active molecule, probably hydrogen. Silver, iron or nickel electrodes are used, with the electrolyte consisting of alkali carbonates in a magnesia matrix.

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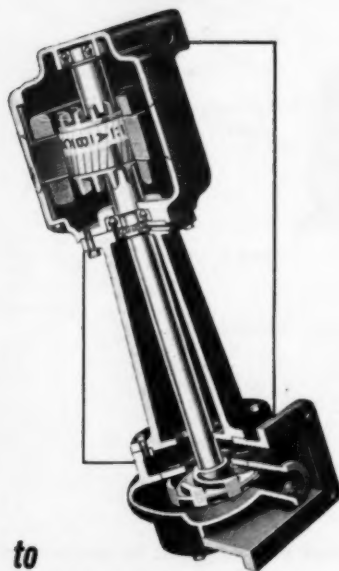
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#### Other Fuels

Organic fuels such as alcohols and aldehydes have been used successfully in fuel cells. Power output, however, is small and only short time operation is possible. Because of the large number of compounds, both organic and inorganic, that can be chemically oxidized or reduced, an indefinite number of fuel cell systems is theoretically possible. The choice is limited to those systems that can be made electrochemically oxidizable or reducible.

#### Regenerative Fuel Cells

In a typical fuel cell, the fuel and oxidant are fed continually into the cell where they are electrochemically consumed, generating electricity in the process. The regenerative fuel cell departs from this usually accepted definition in that it represents a closed cycle system much like a storage battery. The net reaction of any fuel cell is:



If an external source of energy is applied in such a way that the products are transformed back to the original fuel and oxidant, the requirements of a closed cycle regenerative fuel cell are met. This energy may be electrical, thermal, radioactive or photochemical. Electrical regeneration is entirely analogous to the automobile storage battery.

#### The Redox Cell

A second type of regenerative fuel cell, although not a closed cycle with respect to the fuel or oxidant, is the redox cell. The term "redox" is applied to any system where both the oxidized and reduced species are in the form of electrolytic ions. It is these ions which comprise the cell reactants, undergoing oxidation or reduction (giving up or taking on electrons) at the respective electrodes. The products represent the oxidized or reduced counterparts of these ions. The oxidized product and the reduced product are caused to combine chemically with the fuel and air, respectively; reforming the original cell reactants. In this sense, only the cell reactants represent a closed cycle, whereas the fuel and oxidant are fed continually into the cell but do not themselves enter into the cell reaction.

Abstracted from a technical paper entitled "Fuel Cells—A Realistic Approach".



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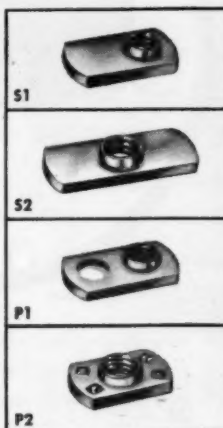
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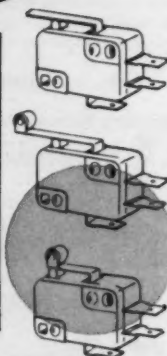
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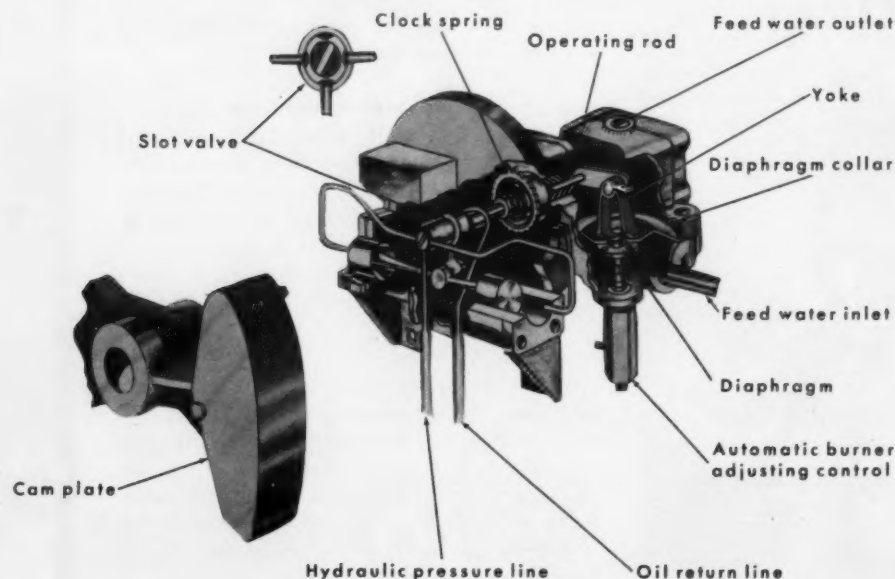
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DESIGN  
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NEWS

CONTROLS

## Valve Regulates Fuel-Air Ratio from Feed Water Flow

Lars G. Soderholm, Midwest Editor



A servovalve senses a boiler's requirements from its feed water flow and automatically regulates the delivery of fuel and air according to the position of a hydraulically controlled cam plate. A movable diaphragm is raised by the water flow to open a slot valve directing oil to one of two hydraulic pistons. As the pistons move, they adjust the slot valve to shut off the flow of oil and simultaneously move the servo cam plate to secure a new air damper setting and gas flow valve position.

The flow of feed water to a boiler gives a good indication of the load being placed upon the boiler at the time. In order to secure economical operation, it is desirable that the fuel-air ratio be adjustable through the complete load range to obtain the highest possible efficiency. A leading manufacturer of boilers uses the servovalve in which the volume of feed water (not pressure) is hydraulically amplified to provide a cam plate setting that gives correct fuel-air proportions.

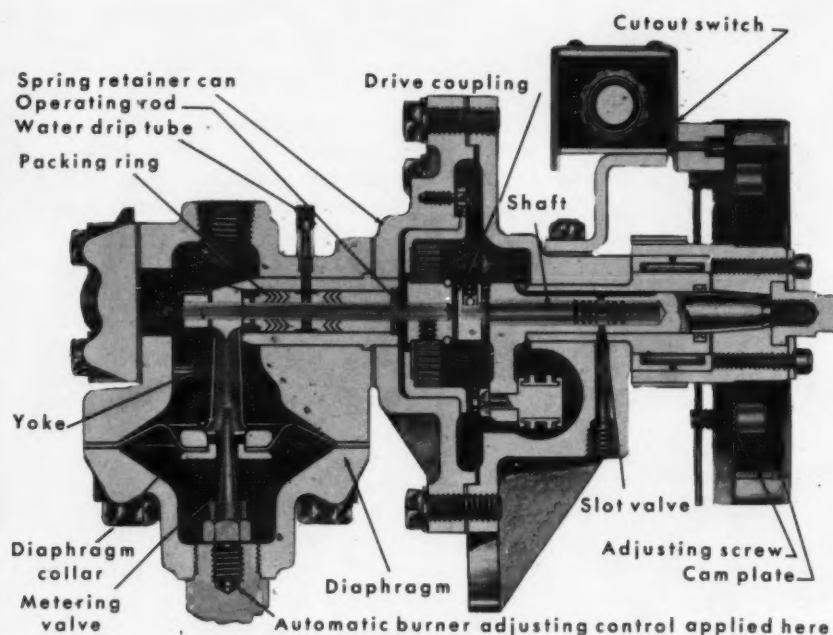
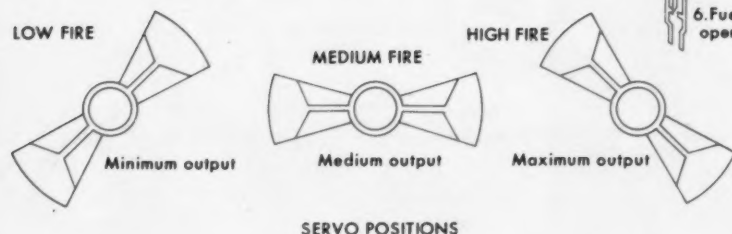
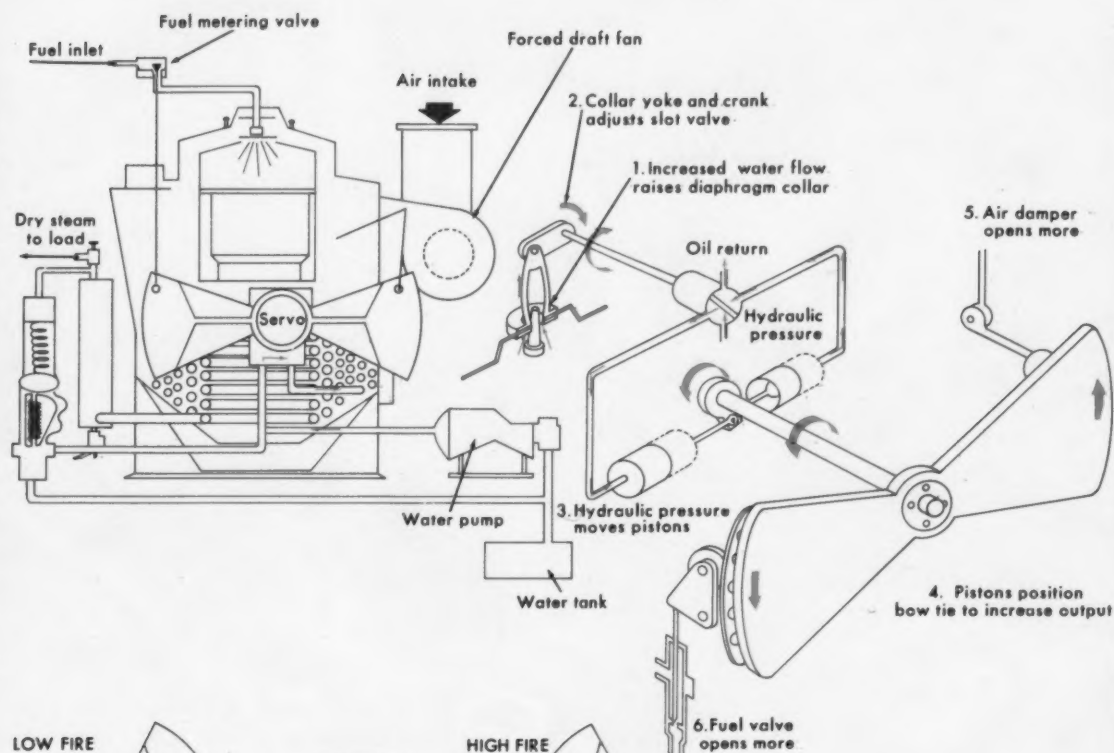
In operation, the feed water enters the valve through a diaphragm chamber. Water comes in the lower side of the chamber and flows up through an opening between the diaphragm collar and a tapered metering pin. The diaphragm rises in re-

lation to the tapered metering pin by an amount directly proportional to the water flow. This motion is transmitted through a yoke and radius arm to an operating rod at the end of which is located a slot valve.

As the slot valve is rotated, ports are opened, releasing oil to either right- or left-hand pistons in an opposing two-piston assembly. As one side of the piston assembly receives pressure and the piston advances, the other piston is being vented. Both pistons are linked to an extension arm on the slot valve shaft. As the piston assembly responds to pressure, the movement of the pistons turns the slot valve shaft to cut off the oil supply when the necessary correction has been made. The slot valve shaft also holds the cam plate which is repositioned each time a correction is made to maintain the proper fuel-air mixture being sent to the boiler combustion chamber.

The cam plate works through a damper arm and bearing assembly to regulate the position of the combustion air damper. The adjustable gas flow valve is controlled through a linkage connection.

The Servo-Modulatic valve is manufactured by the Vapor Heating Corp., Chicago, Ill.



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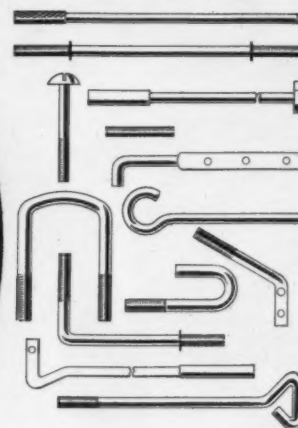
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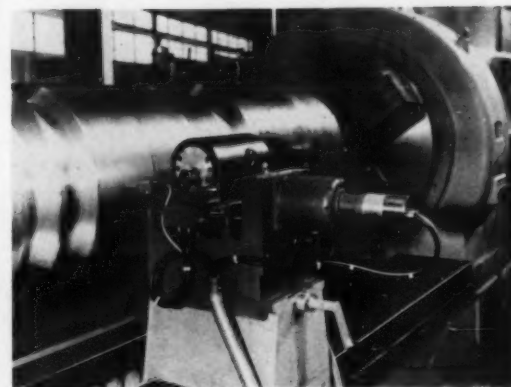
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## IDEAS...CONTROLS

### Electromagnetic Field

R. F. Stengel, German Editor



A device for measuring outside dimensions of ferromagnetic workpieces uses two inductance coils to generate magnetic fluxes across two parallel air gaps. One gap separates a coil from the workpiece; the other gap includes a control surface which serves as known reference point. Main advantage over measurements by direct contact is absence of wear on the measuring head; in addition, surface impurity layers of dirt or liquid have no effect on measurements.

Each head consists of a U-shaped coil with iron core; the open side faces the surface of the workpiece or the control. Voltage applied to a coil causes magnetic flux from the iron core through air gap to metal. The control head facing the control surface is set for an air gap of 0.5-1.0 mm. Differences in gap width result in different inductivities for measuring heads. A bridge circuit translates this difference into a proportional a-c voltage; the phase indicates the sign of the difference.

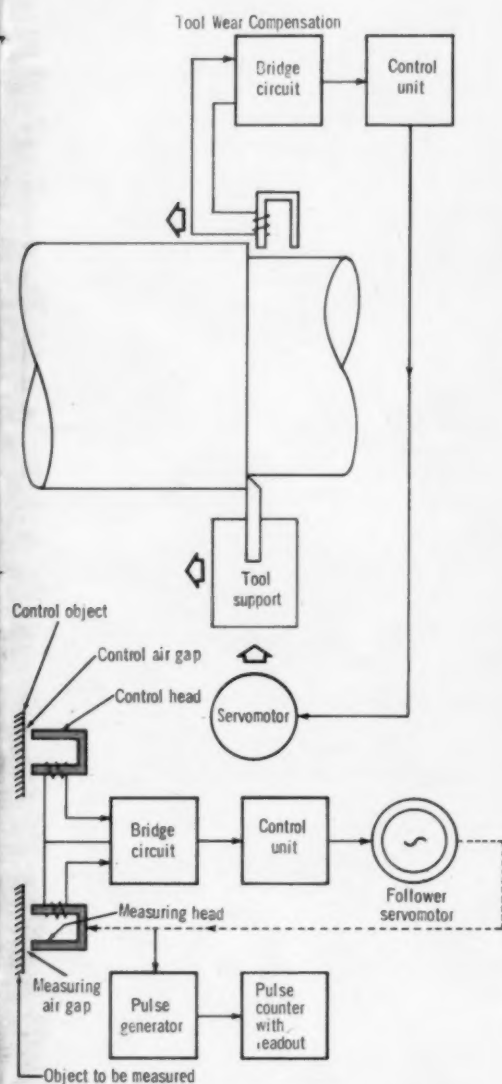
The a-c voltage is amplified and drives a follower servomotor which moves the measuring head until both air gaps are equal. The measuring head is rigidly connected to a high-precision gear rack which drives the input pinion of a pulse generator. Each 0.01 mm of rack travel causes one pulse; total drive is 100 mm.

Pulse sign indicates direction of motion. The pulses are counted and displayed on a ground-glass readout window, with pushbutton reset to zero.

A modification of this basic control device has been applied to lathes for long heavy workpieces. As the tool support travels along the



## Measures Dimensions



workpiece, tool wear causes a gradual increase in machined diameter. Taper is avoided by a single measuring head which sits opposite the tool support and moves in parallel with it. As taper sets in, the air gap between measuring head and workpiece decreases. Resulting change in inductance is translated into radial motion of the tool support which takes up tool wear.

The "Device for Contactless Measurement of Profiles and Diameters with Digital Readout" is manufactured by Brown, Boveri & Cie. AG, Mannheim, Germany.

### Sees Increased Sales, Lower Profits

Its midyear report confirms [redacted] Company's prediction for the current fiscal year. Despite increased sales volume, profits have been substantially lower than expected.

### Rising Costs Cut Profits, [redacted] Reports

[redacted] Company's 1st half in profits, according to the Company's president. Increases in the cost of several basic manufacturing items accounted for a good portion of this tapering of profits.

### [redacted] Reports 2nd Quarter Drop

[redacted] Manufacturing reports its 2nd quarter showed a drop in net profits. A spokesman reported that this condition arose despite slight increase in sales.

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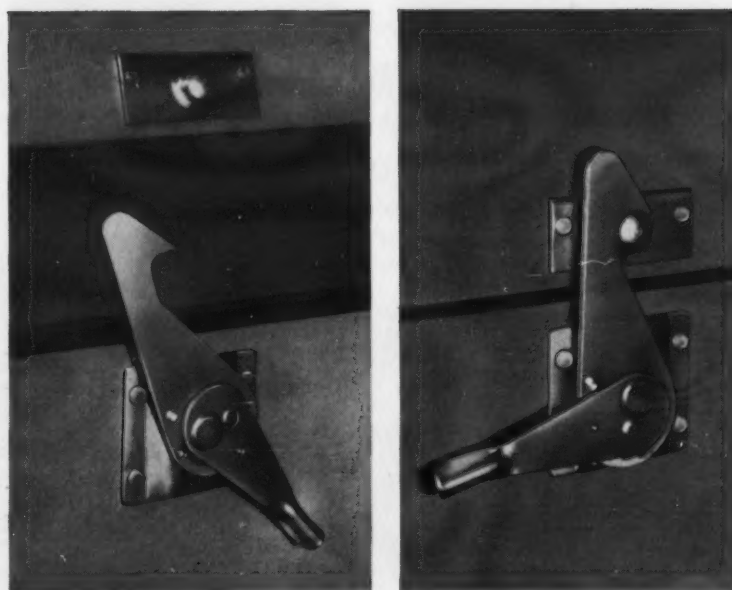
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## WHAT HOOK-LOCK IS

**HOOK-LOCK** is a springless, positive-locking latching device which is ideally suited for use on rigidly specified military transit cases as well as less expensive commercial containers. It provides high closing pressure and tremendous load-carrying capacity...is impact and shock-p-roof. **HOOK-LOCK** is so designed that it lies flat against the mounting surface whether in open or closed position. Since operation is parallel to mounting surface, no space for operating clearance is required.

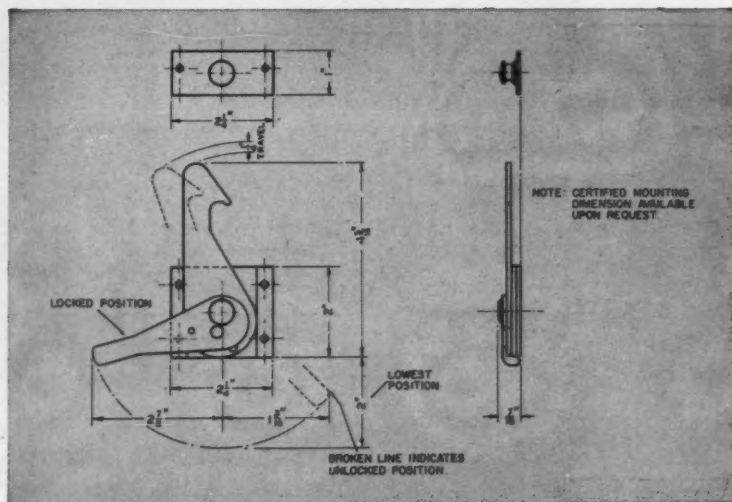


**HOOK-LOCK** lies flat against mounting surface, open or closed.

## New—HOOK-LOCK container latch...It's flat!

## FEATURES

- Shock-proof—solid construction...withstands high impact blows *directly on the fastener.*
- Closing pressure of 200 lb. Where needed, pull-down pressure can be substantially increased by modification of operating lever.
- Tensile load capacity: 750 lb.
- Compact—lies flat open or closed. Extends just 7/16" from container surface at thickest point.
- Positive-locking and springless. Unaffected by arctic temperatures.
- No operating clearance required, because hook and lever move parallel to mounting surface.



**IF YOU** have questions regarding the possible application of HOOK-LOCK or other Simmons industrial fasteners to your particular needs, your inquiry will receive our immediate attention. Contact your nearest Simmons office or write direct.

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## NEW BOOKS

THE HISTORY OF MODERN CULTURE defines culture as including everything made or changed by mankind, such as tools, buildings, cultivated soil, domesticated animals and mental products (language, social organizations, religion, science and art). Cultural evolution therefore is taken to comprise both human and cultural phenomena. Part I of this voluminous book deals with origins and early evolution. Part II covers the emergence of modern culture. Here, the author, Maurice Parmelee, will be at variance with some of his readers. While he claims his point of view and method are as scientific and unbiased as possible, his attack on capitalism and religion displays some prejudice. For example, on capitalism: "The foregoing discussion indicates that economic well-being and genuine liberty for the great majority can come neither through a theoretically unrestricted individualism nor through the authoritarianism of monopolistic capitalism. It is becoming increasingly clear and more widely recognized that these ends can be attained only under a genuine socialized system." "Waste is inevitable under capitalism because otherwise the harvest of profits cannot be reaped. In a socialized system all this waste can be swept away and great economies effected." On religion: "Religion violates the civil liberties in many ways. For example, in the United States the testimony in court of an avowed atheist is highly suspect." "The prohibition of organized religion would not mean a violation or restriction of democracy, but would be the elimination of one of its most dangerous foes." In spite of the above bias, much of this treatise, including subjects such as evolution, the dynamics of behavior, science and technology, is well presented. Philosophical Library, Inc., 15 E. 40th St. New York 16, N.Y.: 1295 pages: \$10

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## Boxed in by present materials?

### KRALASTIC

Often design ideas are left on drawing boards due to the unavailability of proper materials. In fact, many companies have been unable to put advanced designs into production solely because of this condition. There is a solution, however, Kralastic® ABS resins.

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term design strength allows for thinner walls. It can be easily injection molded, vacuum formed or deep drawn without damage to its surface or impairment of its physical properties. Moreover, Kralastic allows complete units to be molded, eliminating post-operational labor, assembly, and finishing costs.

Offering an amazing combination of strength and dimensional stability, Kralastic is available in all colors, colors that keep their rich luster indefinitely. For more information on Kralastic, write to Naugatuck Chemical, Elm Street, Naugatuck, Connecticut.

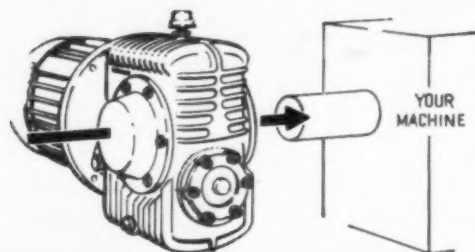
Naugatuck Chemical Division



**United States Rubber**



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Cone-Drive gearmotors are available for all AGMA service ratings. Call your Cone-Drive representative today or write for catalog #58 for complete specifications.

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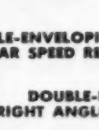
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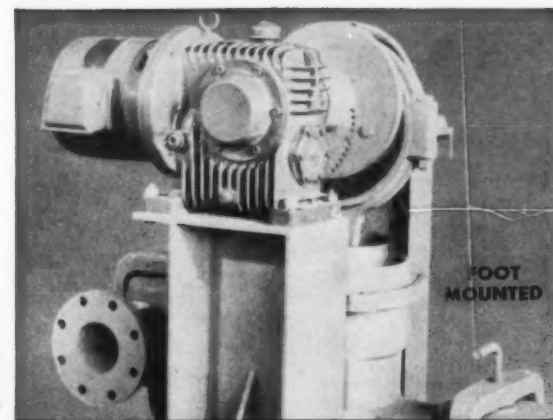
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GEAR SPEED REDUCERS



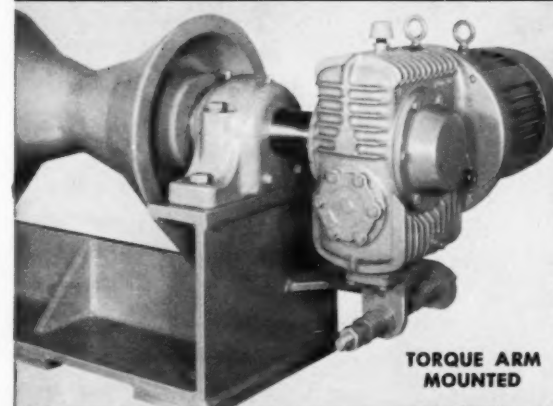
DOUBLE REDUCTION WORM  
GEAR SPEED REDUCERS



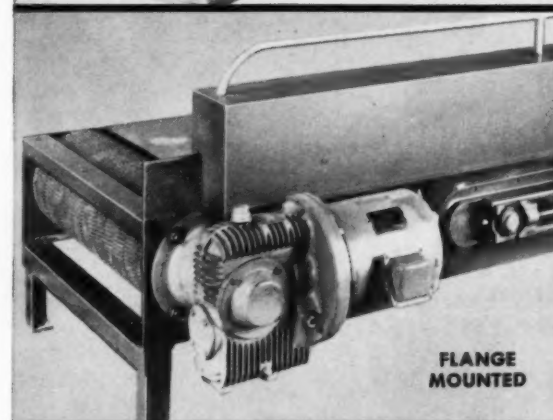
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MOUNTED



TORQUE ARM  
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TORQUE  
ARM  
MOUNTED

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THE PHYSICAL PRINCIPLES OF ASTRO-NAUTICS provides a concise but thorough exposition of basic principles of astronautics, designs and technology of the placement or control of manned and unmanned objects in space. The amply illustrated volume discusses principles of astronomy, foundations of mechanics and dynamics of space flight. Several illustrative problems are worked out within the body of the book and additional unsolved problems, many with answers, are arranged so that the reader may test his understanding of each chapter. Physics of the solar system are given advanced treatment. Subjects in mechanics such as weight and weightlessness and Coriolis acceleration, which often are given only limited coverage in introductory physics courses, are treated in depth. Arthur I. Berman: John Wiley & Sons, Inc., 440 Park Ave. S., New York 16, N. Y.; 350 pages; \$9.25.

SYNTHESIS OF OPTIMUM CONTROL SYSTEMS is devoted to automatic control system design. It presents advanced design techniques for high-performance systems where the ultimate in response is required. Optimization of sampled-data control systems with stochastic inputs, Pontryagin's maximum principle and its digitized version, the parameter determination problem and self-optimizing systems with random errors are included. The book is useful also as a reference for servo designers and research engineers. By Sheldon S. L. Chang; McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N.Y.; 381 pages; \$11.75.

TEMPERATURE MEASUREMENT IN ENGINEERING, Volume II, presents how-to-do-it directions for the measurement of temperatures in situations which actually arise in the laboratory, shop and field. The book is arranged in classes of circumstances where temperature measurements are desired. First part is devoted to discussion of systematic development of basic methods, resistance-thermometry and radiation-pyrometry techniques. Second part offers a detailed treatment of specific problems of temperature measurement and the techniques most suitable for solving them. All equations are stated in a form suitable for direct application. Symbols are defined in the text following the particular equation and group of equations relating to one topic. Application illustrations consist almost entirely of tried and tested designs. More than 1000 references are included in the book. H. Dean Baker, E. A. Ryder and N. H. Baker; John Wiley & Sons, Inc., 440 Park Ave. S., New York 16, N.Y.; 510 pages, \$13.

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## BOOKS

**GYROSCOPES: THEORY AND DESIGN** is basically an introductory and reference text in gyro art. It specifically deals with high-precision gyro instruments. The first three chapters provide an introduction to the mechanics of a spinning wheel. This is followed by a chapter on restraints, which is the basis of any system consideration in which a gyro element is integrated into an instrumentation system. Chapters on stable vertical and meridian-seeking systems follow. Two chapters deal with inertial guidance fundamentals and the last four chapters are related to the physical gyro component, its design, performance, mechanical and electrical properties and evaluation. Among the special features is an extensive discussion of "Schuler tuning" and its relation to the earth's curvature. There is also an extensive bibliography and problems are presented at the end of each chapter. More than 200 charts, tables, drawings and photographs clarify important points and summarize valuable data. Prepared by 11 top authorities on the subject, this book is edited by Paul H. Savet; McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N.Y.; 402 pages; \$12.75.

**MEDICAL AND BIOLOGICAL ASPECTS OF THE ENERGIES OF SPACE**, edited by Paul A. Campbell, Col., U.S. Air Force (MC), brings together special knowledges of the medical, biological, astrophysical and engineering sciences in relation to space energies, their conversion and use. The book is a compilation of papers delivered at a symposium held in late October 1960, which was sponsored by the School of Aerospace Medicine of the United States Air Force Center at Brooks Air Force Base, Tex. The symposium was arranged by The South-West Research Institute of San Antonio. Papers included discuss the energies of space and describe their potential applications and dangers for man. Protection against these space energies is discussed. Among the subjects are: solar and cosmic energies, magnetic fields, radiation sources within the spacecraft and gravitational phenomena. Other papers discuss energy conversion, aspects of illumination and photosynthesis, shielding, chemical and biological protection and biological implications of electromagnetic and particulate radiation. An appendix contains definitions of terms, quantities and units and a table of conversion factors. Columbia University Press, 2960 Broadway, New York 27, N.Y.; 491 pages; \$10.



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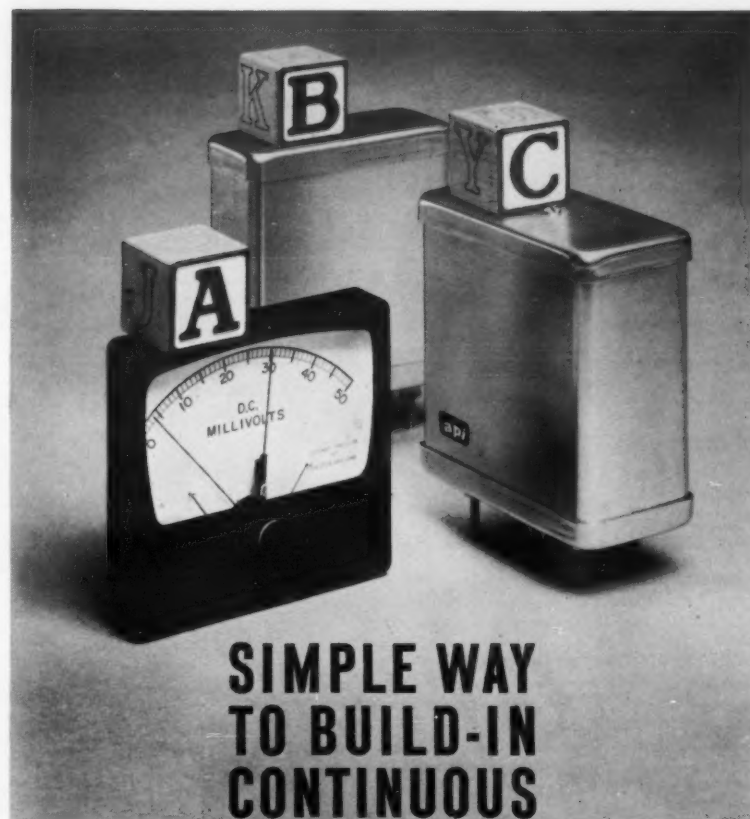
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**MATHEMATICAL PUZZLES & DIVERSIONS** (Second Edition). For those who are inveterate puzzle solvers, this will prove to be a "must" book. The author, Martin Gardner, has built quite a reputation as an author of puzzles. Some of the puzzles in this book range all the way from simple algebraic statements to recreational logic problems. Some are mechanical in nature, some graphic, some strictly mathematical. Many fascinating hours can be spent with such a book. Simon & Schuster, Inc., Rockefeller Center, 630 Fifth Ave., New York 20, N.Y.; 253 pages; \$3.95.

**SHOCK AND VIBRATION IN LINEAR SYSTEMS**, written by Dr. Paul A. Crafton, discusses shock and vibration in linear mechanical and structural systems. The purpose of the book is to give the reader an understanding and mastery of the fundamental principles of linear shock and vibration phenomena and of the methods of application of these principles to general mechanical instructions systems. A modern approach of the operation calculus has been taken. In addition, the concept of the transfer function is used throughout. This approach places the study of shock and vibration on a more general foundation. No prior knowledge by the reader of the operation of calculus or transfer fractions is assumed. Their principle in reference to application is explained in the text. The book is illustrated extensively and contains problems to demonstrate the principles of shock and vibration. Harper & Brothers, 49 E. 33rd St., New York, N.Y.; 415 pages; \$10.

**INDUSTRIAL TRANSISTOR AND SEMI-CONDUCTOR HANDBOOK**. Here is a book which is long overdue and which will be welcomed highly by technicians and engineers who use transistors, but who are not necessarily trying to make their own. While a chapter on semiconductor physics is included, it does not take up the major portion of the book and its 20 pages give about as much detail as is generally desired. The remainder of the volume is written largely to show how transistor circuits can be constructed. Part values and transistor type numbers are liberally included. Admittedly, this does give a "cookbook" approach to transistor use but often this is exactly what is wanted. Chapters are divided into areas of usage such as power converters, communications or industrial control. A good, concise handbook for those desiring circuits which furnish a point of departure for starting their own designing. Howard W. Sams & Co., Inc., 1720 E. 38th St., Indianapolis 6, Ind.; Catalog No. TTT-1; 254 pages; \$4.95.



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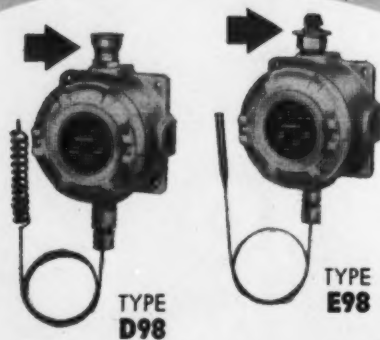
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Temperature Ranges . . . .	Type D98 — 300° or 550° F between limits of -150° and +650° F. Type E98 — 100° or 200° F between limits of -150° and +650° F.
Thermal Assemblies . . . .	Various shapes and sizes of thermal assemblies available. Completely liquid-filled bellows, bulb and capillary assembly.
Switch Ratings . . . . .	15 amps. at 115 or 230 volts AC, also 20 amps. or DC switches on specification.
Switch Types . . . . .	N.O., N.C., or Double Throw, no neutral position.
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Size & Weight . . . . .	9 1/4" x 5 3/4" x 3 3/8" — weighs approx. 8 lbs. 4 oz.
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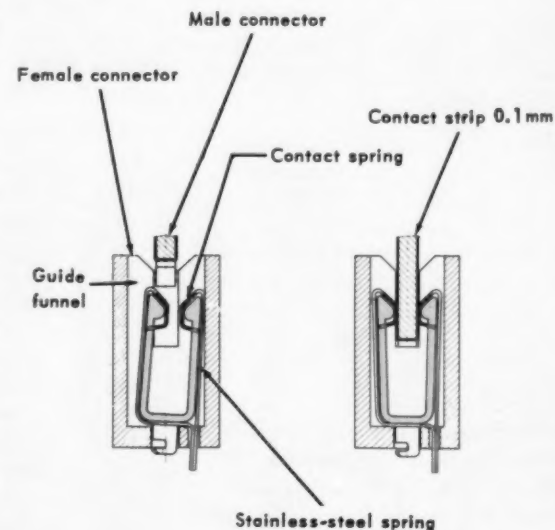
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## DESIGN IDEAS IN THE NEWS NEWS

### Novel Connectors Eliminate Contact Loss

Connectors on 0.1-inch contact centers for printed circuits eliminate contact loss when boards are coded to prevent misplugging. The new design is insensitive to deformation of boards by aging or humidity; the guiding system forces contacts of male and female connectors to engage positively. No bending stress is involved, and soldering points between contacts and circuit conductors are unaffected by plugging.

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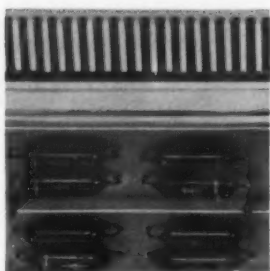
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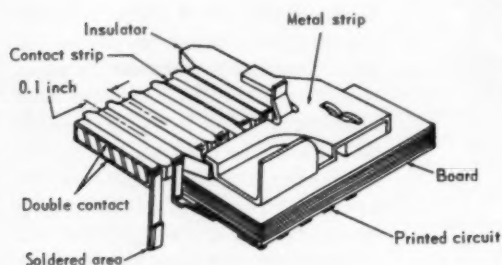
**MALE CONNECTOR**, tested in more than 10,000 plug-in operations, can be equipped with any number of contacts for board thickness up to 0.1 inch. Only two holes in board are required to mount male connector. Each corner (top) of insulator is reinforced by metal strip and shaped to guide board into female connector. Protruding insulator sections abut against metal strip for rigidity during plug-in. Insulator is stamped to insure uniform contact spacing; guide corners prevent contact making before connectors are matched.



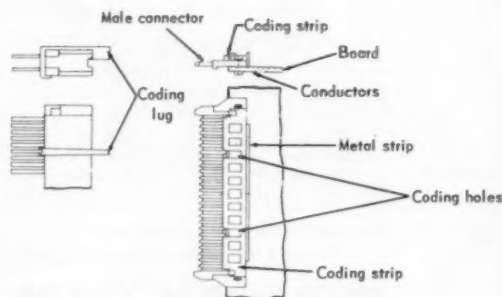
any board size. Contact lugs of female connectors are alternately turned 180 deg and staggered to facilitate soldered or wrapped connections and to halve the force required for plugging the board complete with male connectors into the female connectors.

The design, claimed to be one of the most advanced contributions to international connector standardization, is by Standard Elektrik Lorenz A.G., Stuttgart, Germany (an ITT Associate).

R.F.S.



**DETAIL** of male connector. Gold-coated wire is rolled flat to form round-edged contact strip without burrs. All double contacts are simultaneously laid by machine around insulator sections between teeth and folded into soldering lugs. Plugging force is max 4.5 lb per 10 contacts, extracting force 20 percent less.



**LOSS-FREE CODING PRINCIPLE** requires coding lugs clamped around female connector and coding strip fastened to male connector, in which up to 11 holes are punched (for every 25 contacts). Protruding lugs prevent engagement. No contact point is lost.

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. . . but not on your payroll.

#### \*Advanced Control Engineering Specialists

. . . do not cost you a penny—but they *could* open new markets, strengthen old ones . . . make possible product performance breakthroughs never before possible! The Warner ACES\*—a thoroughly experienced and imaginative group of electric clutch and brake design engineers (who work with *your* men) can bring your company experience gained in hundreds of applications of low-torque drives.

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Warner engineers, working closely with Instron Engineering Corporation's own design group, helped develop basic product improvements in Instron's tensile testing equipment. Fractional hp Warner electric brakes and clutches made possible such advances as: greater accuracy and speed, added versatility, and foolproof operation—as well as lower cost. Find out what Warner ACES\* unique design service can do for *your* products today!

## WARNER ELECTRIC

Warner Electric Brake & Clutch Co., Beloit, Wisconsin



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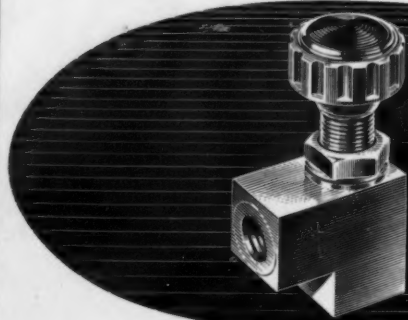


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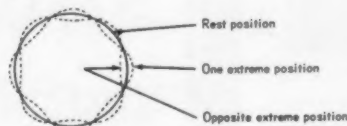


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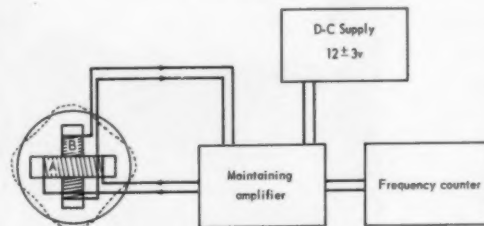
Circle 133 on Reader-Service Card for more information

## IDEAS IN THE NEWS

MODE OF CYLINDER VIBRATION



MEASURING UNIT



• **FLUID DENSITY** is measured by a resonating cylinder probe immersed in the fluid. The resonant frequency is accurately related to density.

The principle of operation is simple. A bell, when struck, vibrates in many different modes. These modes have a different pitch or frequency, and die away at different rates. One of the most lasting notes is that in which the vibration mode of the bell lip is as shown.

A thin cylinder, made to resonate in this way, has the advantage over a bell that can be maintained in continuous vibration. Two coils act as separate driving and sensing elements and a miniature, encapsulated transistor amplifier completes the feedback loop.

The medium surrounding the cylinder wall moves with it, and the more dense this medium is, the greater the mass that has to be moved. The medium-density thus contributes mass to the vibrating system with a resultant fall in frequency. The relationship between frequency and density follows closely to the form

$$(fD/f_0)^2 = \frac{1}{1 + K}$$

where  $fD$  is the frequency at density  $D$ ,  $f_0$  is the frequency at zero density and  $K$  is a constant depending on the diameter and thickness of the cylinder wall.

Possible sources of error could be viscosity, nonhomogeneity of the measured medium, corrosion, erosion, encrustation and temperature. A less predictable source of error is variation in pressure difference across the cylinder wall. Experience has shown that viscosity has little effect. Liquids of widely different viscosity (1 to 100

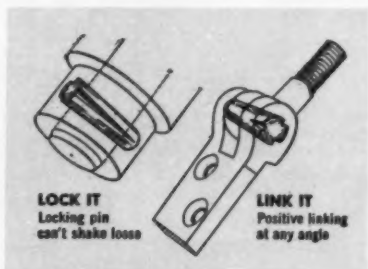


To join two parts as one...

## THE SOLID GROOV-PIN

Every one of the Groov-Pins shown here was designed with your pin problems in mind. Designed to withstand the rigors of constant shock and vibration without loosening...to drive easily into a simple drilled hole...for faster hand or production feeding, including hopper feed...for a permanent connection that stands up to vibration fatigue as only a solid pin can.

Groov-Pins are made to meet your requirements, too. Standard sizes run from 1/32 to 1/2", specials to fit your needs at standard prices over 5,000 pieces. Send for illustrated catalog, free samples.



No matter what your pin problem, there's a Groov-Pin to solve it for you.

## GROOV-PIN CORPORATION

1120 Hendricks Causeway  
Ridgefield, New Jersey  
WHitney 5-6780



Circle 134 on Reader-Service Card

Centistokes) lie on the same frequency/density curve. Gas bubbles affect the reading by change of density, which is the required effect, but excessive damping of the vibration due to energy losses related to those used in ultrasonic cleaning can occur with certain bubble configurations. This will stop the vibration when amplifier power becomes insufficient. In most cases, simple precautions preclude this bubble formation in the vicinity of the cylinder.

Corrosion can be combatted effectively since the cylinder can be made of any magnetic metal and electroplated. Encrustation resulting from crystal growth, for example, and erosion by high-velocity solid suspensions can be avoided in most cases.

A temperature coefficient of 0.01 percent/deg C at 1 g/ml can be achieved, and operation over a wide temperature range is possible. Pressure differential also affects the frequency, and this usually can be overcome by exposing both sides of the 0.8-inch-dia cylindrical probe to the same pressure. Alternatively, the pressure effect can be reduced by thickening the cylinder wall, as this effect roughly varies inversely as the cube of the cylinder thickness, whereas the density effect varies inversely with thickness.

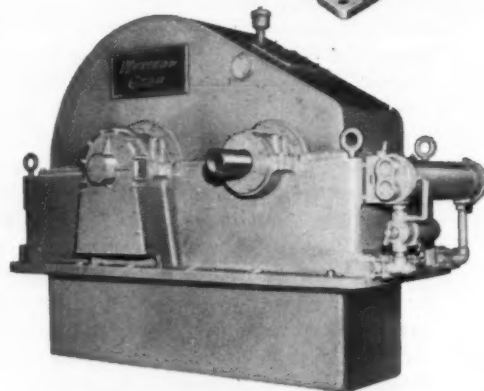
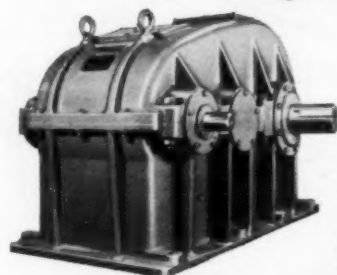
A simple and rapid density reading can be taken from the frequency counter display. The normal practice of a 1-sec count gives continuous monitoring of the density with an accuracy of the order of 0.1 percent of 1 g/ml. The resolution with a 10-sec count is better than 0.01 percent. The frequency readout lends itself readily to line or radio transmission with no added error.

The new fluid density measurement method was developed by The Solartron Electronic Group, Ltd., Farnborough, England.

R.W.E.M.



## POWER TRANSMISSION REQUIREMENTS?



**SPEEDMASTER**  
LARGE HIGH SPEED UNIT

## HOW WESTERN GEAR SERVES INDUSTRY

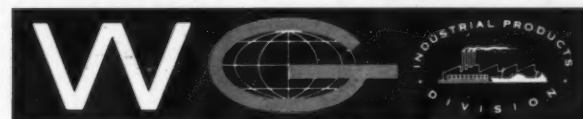
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  - ☐ SpeedMaster Parallel Shaft Bulletin
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NYLON

# Snap Bushings

**NEW From HEYCO®**



**Snaps easily and locks into panels of varying thickness up to 1/4" withstands 35 lb. pushback test!**

## Here's a Bushing to meet your requirements

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- ◆ Various inside diameters

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**Samples are FREE**



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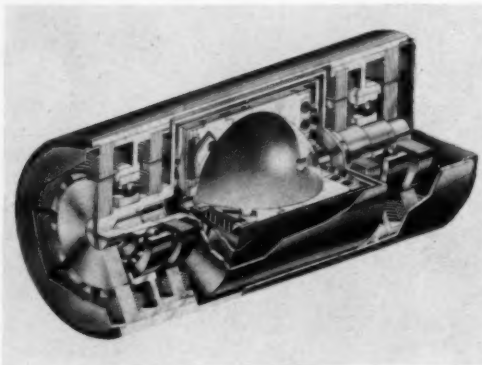
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## IDEAS IN THE NEWS

• **FLUID SPHERE GYRO** has a spinning mass of liquid confined within a hollow sphere. The liquid substitutes for the conventional rotating wheel.

The inherent stability of the fluid spinning inside a simple rotor assembly produces a perfectly balanced and ultrareliable gyro at very low cost. The device can detect motion too minute to be measured by the most sensitive instruments known. It contains less than half the number of parts required by the best conventional inertial gyros.

Bearing wear or shifts in structural dimensions have only slight effect on the performance of the



gyro. It has an anisoelastic drift of less than 0.003 deg/hr/g<sup>2</sup>. It can be stored or operated at temperatures from minus 65 to 200F.

In operation, the fluid spins at approximately the same speed and around the same axis as the gyro rotor. Any angular movement of the rotor from this axis produces variations in pressure between the fluid and the cavity wall. Pressure is sensed by a series of diaphragms buried in the rotor-cavity assembly and opened to the fluid through pickoff ports in the cavity wall.

Pressure variations force the diaphragms to oscillate at an amplitude proportional to the angular displacement between rotor and fluid axes. The phase indicates the axis about which the displacement occurs. The diaphragms acting as elements of a miniature microphone convert pressure variations into electrical signals. The signals are amplified and fed into servomotors which hold the platform in position.

The 2-axis fluid sphere gyro was produced by the Sperry Gyroscope Co., Great Neck, N. Y.



## PUMP DESIGN TRENDS

ARTHUR A. NICHOLS

### SPECIAL PURPOSE PUMPS FOR SPECIAL PROBLEMS

► In over thirty years experience in the design and manufacture of special pumps, we have solved numerous pumping problems where the design and production of a suitable pump was considered almost impossible, either because of the material to be pumped, or because of the precise manufacture necessary to obtain satisfactory performance.

► Nichols pumps are standard for example, in the synthetic fibre industry for pumping rayon, acetate, celanese, nylon and other fibres spun in synthetic fibre plants throughout the world.

► Some interesting new applications for Gerotor pumps have been developed in recent times involving specialized problems in hydraulic servo systems.

► Important advantages are offered by the Gerotor pump for servo control applications. It is a positive displacement pump and provides a smooth power flow from one end of the pumping cycle to the other. Unlike other types of pumps which tend to quit work at the low end of the speed range, Gerotors stay right on the job and provide positive power to the extremely low range. Thus, they are exceptionally responsive in servo systems.

► For electronic equipment operating at high altitudes, air cooling of high input components becomes troublesome because lower air density limits cooling fan efficiency. Liquid cooling systems are therefore frequently preferred for this type of service. Our extensive experience over the years in the production of high performance aircraft engine pumps has been of great value in developing electronic coolant circulators that provide maximum weight and space savings with efficient heat transfer capabilities.

► Special pumps have been designed and manufactured for applications as varied as metering pumps in vending machines and conveying molten solder in production equipment. This long and varied experience in industry-wide pumping applications, combined with years of specialized development and production of pumps for the aircraft engine, super-charger, missile, helicopter and electronic field is available to today's designer faced with new and unusual pumping applications and problems.

► Technical data is available and your inquiry is invited. Write:

### W. H. NICHOLS CO.

Makers of Zenith Metering Pumps and the Nichols Milling Machine "the miller that uses its head".

48 WOERDAVE, WALTHAM 54, MASS.

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**WATERMAN**

Series 1407

**FLOW REGULATORS**

Full range  
Adjustable  
Pressure Compensated  
Flow Control  
to 5000 p.s.i.

Waterman Series 1407 is a group of compact, low-cost, pressure-compensated flow regulators, adjustable over a series of unusually wide flow ranges, for convenient on-the-job speed control of hydraulic cylinders and motors.

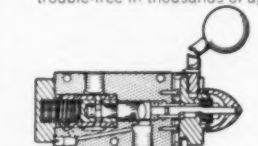
Rated for pressures to 5000 p.s.i.

Controlled flow to 40 g.p.m.—ideal for hydraulic motors as well as cylinders. Factory-tested to 10% tolerance.

Wide range of adjustability—turndowns of as much as 80:1.

Choice of mountings and operating devices. 1/2" N.P.T.F. size meets most needs—standard sub-plate mountings available.

Compact and light in weight—proved to be trouble-free in thousands of applications.



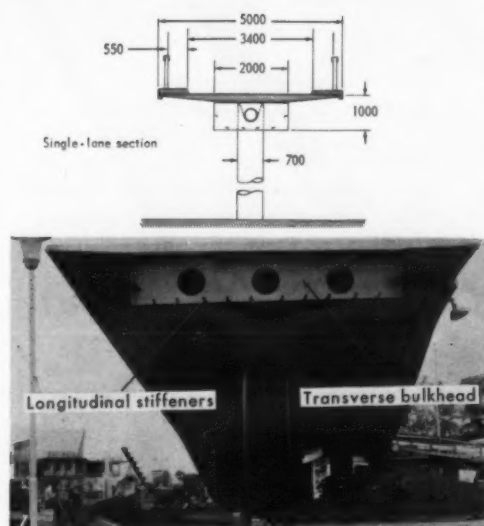
Unit senses pressure drop across variable orifice and reacts to control flow within desired limits.

W-5120

**WATERMAN**  
HYDRAULIC CORPORATION

725 Custer Ave., Evanston, Ill.

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• **STEEL COMPONENTS AND REINFORCED CONCRETE SLABS** in standardized prefabricated units permit rapid construction of elevated highways with minimum interruption of surface traffic. Low weight and bolt assembly of major components reduce installation time of 100-ft spans to a single shift.

The only components requiring surface space are single 700-mm-dia steel columns for each lane, normally spaced 100 ft apart. Each column supports a basic highway element with box cross-section. Bottom and sides of the box consist of sheet steel stiffened with longitudinal profiles and provided with transverse bulkheads.

The top of each box is formed by prefabricated reinforced concrete slabs which are attached to the steel components by bolts. As bolts are torqued down, friction between concrete and steel becomes sufficiently high to absorb horizontal shear forces. Box units have manholes to provide access and inspection of assembly bolts.

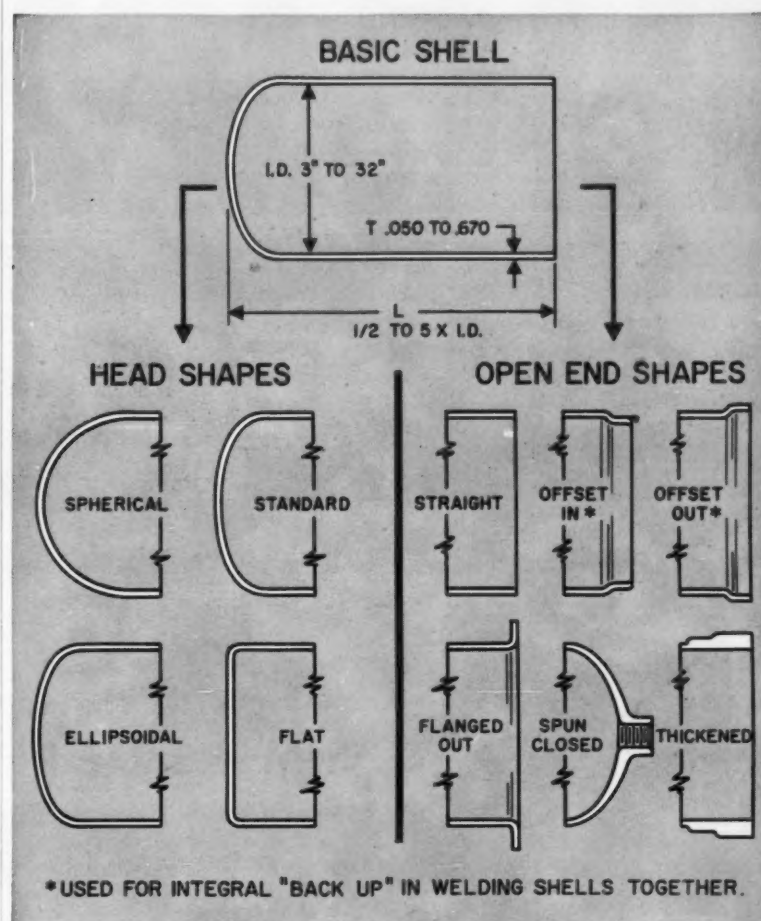
For installation, vertical columns are set first, with bottom ends fully restrained. Space requirements for column foundations vary with local soil characteristics. Box units then are placed on top of columns; light weight of 100-ft unit span permits positioning by mobile crane. Steel box walls of adjacent units are welded together; longitudinal stiffeners are connected by bolting. A high-strength mortar fills the joints between the reinforced concrete slabs.

Widths in prototype installation are 3400 mm (about 11 ft) for single traffic lane, 6000 mm (about 20 ft) for dual lane. Widths can be changed to conform with different highway codes. Curves, grades and forks can be assembled through modification of the basic straight unit.

The prefabricated elevated highway is a product of Fried. Krupp Maschinen-und-Stahlbau, Rheinhausen, Germany

R.F.S.

**Your ideas...our methods...give you reliable components at low cost**



The drawings shown here give you a simple description of the way you can use basic Hackney shells to produce a variety of seamless, lightweight, strong, low-cost rocket motor cases, gas generator housings, control actuator pressure vessels and other missile components.

The basic unit is a cold drawn, deep shell which has uniform wall thickness from top to bottom in ranges from .050" to .670". I.D.'s vary from 3" to 32". The length of the shell may be from 1/2 to 5 times the diameter—or up to 110".

Head shapes—spherical, standard, ellipsoidal, flat or special. Open end shapes offer variety—straight cut, offset in, offset out, flanged out, flanged in, spun closed or thickened. Capacities begin at 1 quart—go as large as 100 gallons. Working pressures range from 100 to 6000 psi, depending upon diameter and wall thickness.

For full details of our facilities and our methods of making components, write to the address below.

## Pressed Steel Tank Company

Manufacturer of Hackney Products Since 1902

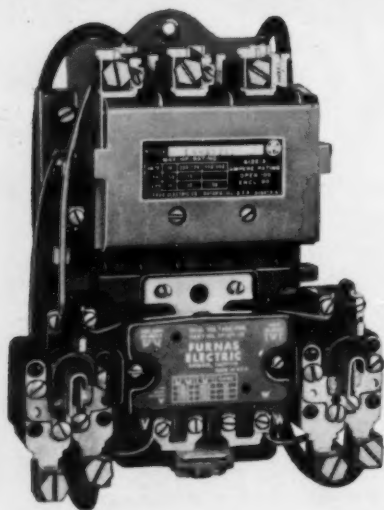
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Branch offices in principal cities



CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS  
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# NEW SIZE 3



1/3

## SMALLER

The new compact Furnas Size 3 magnetic starters, 1/3 smaller than other Size 3 models, incorporate inherently trip-free melting alloy type thermal relays for greater motor protection, and a simplified, low wattage, electromagnet design. For 2, 3 and 4 pole, 30-50 hp.

- Dual voltage, dual frequency encapsulated coils; fungus and moisture resistant.
- Silver-cadmium oxide contacts.
- 1/3 smaller than other models.
- Trip-free thermal overload relays.
- Mounting dimensions on open type identical to Sizes 2 and 2 1/2.

Write today for Bulletin 14-B3, 1078 McKee Street, Batavia, Illinois

A109

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COMPANY • BATAVIA, ILLINOIS**

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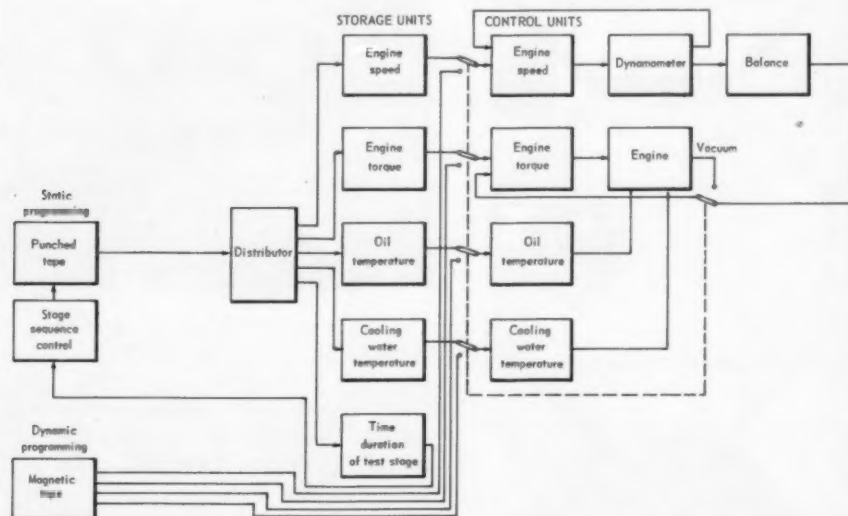


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## IDEAS IN THE NEWS

• **DIGITAL CONTROL SYSTEM** permits exact simulation of roadtest conditions for automotive engines with repeated playback of an actual roadtest or with an arbitrary environment program.

For arbitrary programming, a set of artificial operating conditions represents a test stage. Stage data and stage duration are recorded on punched tape, from which information enters separate stor-



## MARVEL Synclinal FILTERS

**FOR DEPENDABLE PROTECTION on all HYDRAULIC and other low pressure circulating systems**



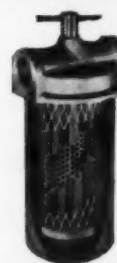
### Synclinal Sump Type

**Capacities:** 5—8—10—20—30—50—75 and 100 G.P.M.

**Pipe Sizes:** 3/4"—1"—1 1/4"—1 1/2"—2"—2 1/2" and 3".

**Connections:** Coupling—Male Nipple.

**By-pass Valve:** Not Available.



### Synclinal Line Type

**Capacities:** 5—8—10—20—30—50—75 and 100 G.P.M.

**Pipe Sizes:** 3/4"—1"—1 1/4"—1 1/2"—2"—2 1/2" and 3".

**By-pass Valve:** Not available.

**Operating Pressures:** Up to 80 p.s.i.



### Bonded Line Type

**Capacities:** 10—20—30—50 and 75 G.P.M.

**Pipe Sizes:** 1"—1 1/4"—1 1/2"—2" and 2 1/2".

**By-pass Valve:** Available with or without.

**Operating Pressure:** Up to 250 p.s.i.

**Operating Temperatures:** Up to 300° F.



### In-Line Filter

**Capacities:** Up to 60 G.P.M.

**Pipe Sizes:** 3/4"—1"—1 1/4" and 1 1/2" (at both inlet and outlet).

**By-pass Valve:** Available with or without.

**MARVEL ENGINEERING COMPANY**  
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**CONTROL CONSOLE** contains tape read-in, storage and control units, has glow tubes for numerical display of operating conditions.

age units for rpm, torque, cooling water and oil temperature, and stage duration. The storage units correspond to transistorized control units which govern the operating conditions of the engine.

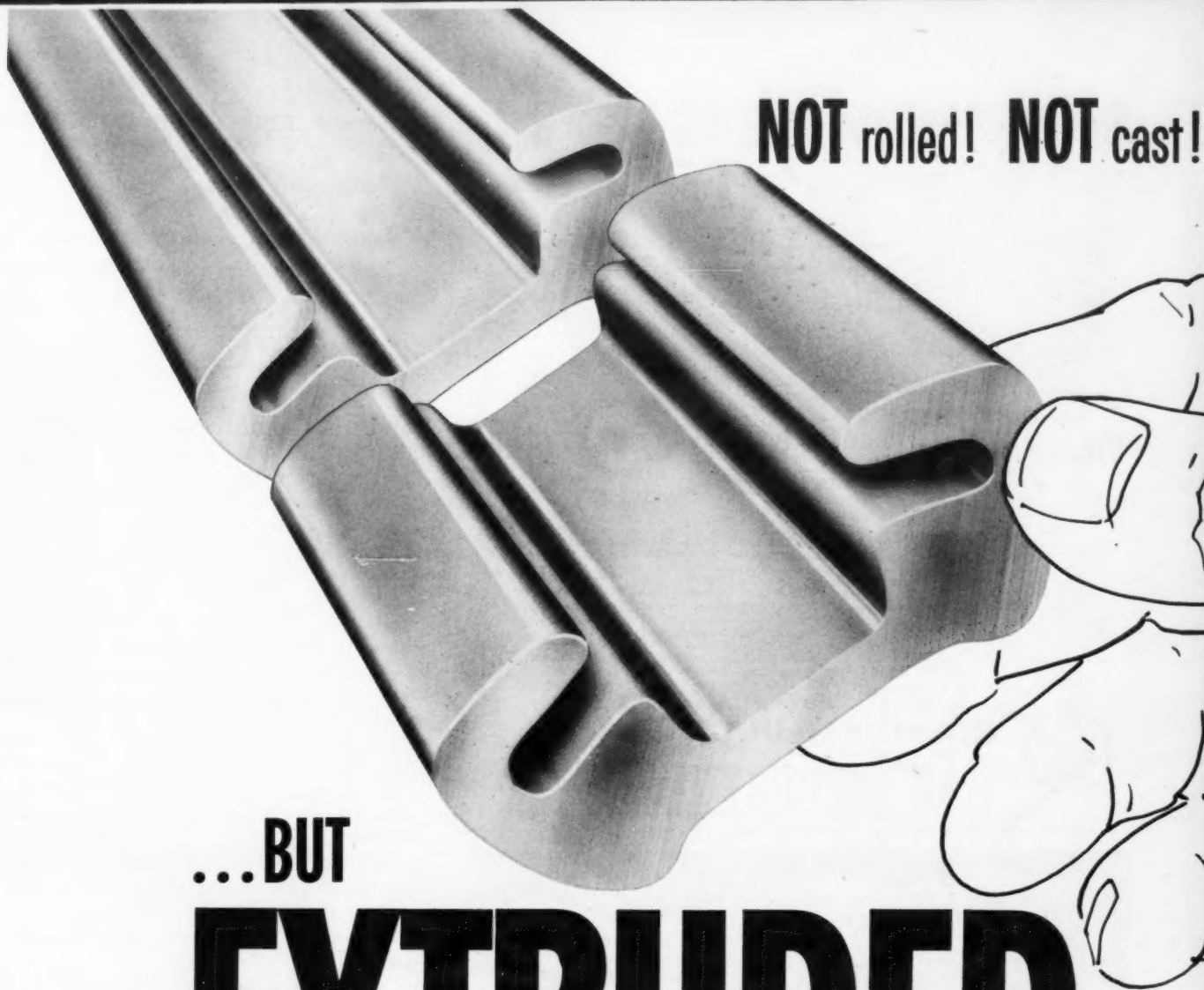
A dynamometer, a balance, thermometers and a fuel meter record engine performance. A stage sequence control advances the test program. Testing can be automated by using recording instruments and by including a shutdown command in the program tape.

Magnetic tape recordings of actual road tests lack extreme reproduction fidelity of punched tape; high-frequency flutter in rpm and torque is lost because of control lag and difference in inertia between a complete automobile and an isolated test-stand engine. On the other hand, recordings from a single actual road-test can be used to repeat a continuously changing environment.

To permit use of commercial tape-recording equipment, engine speed data are recorded as pulses. On the stand, a frequency-voltage transformer converts the pulses into input signals for the analog-type engine speed control; a digital feedback loop corrects static errors.

The digital programming unit for testing of automotive engines under simulated roadtest conditions was developed by Siemens-Schuckertwerke AG, Erlangen, Germany.

R.F.S.



**NOT rolled! NOT cast!**

...**BUT**

**EXTRUDED**

**IN STAINLESS STEEL, CARBON STEEL, ALLOY STEEL and SUPER ALLOYS !**

**NOTE ABOVE:** The indentations on the extruded product shown above do not lend themselves to rolling mill practice. Extruding this product in one operation at The H. M. Harper Company eliminates costly secondary operations. This extruded shape typifies the lower in-place assembly costs that can be realized from the new stainless steel extrusion techniques by Harper. Just send us your requirements, regardless of how difficult

the desired shape may appear to be. We alloy the metal to your specifications; design the die to your exact needs; and extrude your shapes through the Harper High-Speed Extrusion Press technique. Every bit of metal is used—no waste of materials; secondary machining is largely eliminated; and make-ready costs are low. More important—you receive a **stronger** product with **better** grain structure, **better** uniformity, and **better** appearance.

*Write, wire, or phone for complete details*

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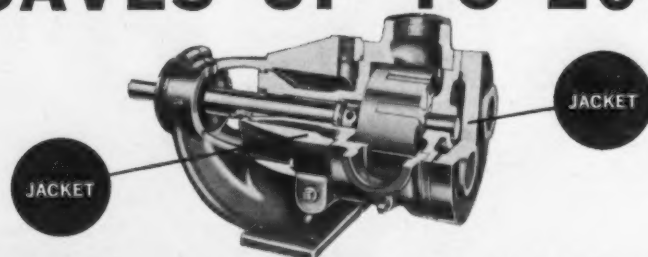
SHAPING METALS THAT SHAPE YOUR FUTURE

CORROSION-RESISTANT FASTENINGS IN ALL ALLOYS

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## NEW DESIGN SAVES UP TO 20%



### VIKING'S COMPLETE NEW LINE OF JACKETED STAINLESS STEEL\* PUMPS

\*Also other alloys—nickel, Monel, steel, Ni-Resist, etc.

Now you save money on new type stainless steel\* Viking Pumps and still get that same rugged, heavy-duty service. The new, improved design makes it possible. All parts coming in contact with the material handled are stainless steel or other specified alloy—other parts are cast iron. Its unique design incorporates a jacket chamber around the back of the pump, around the mechanical seal or packing chambers and over the head of the pump. This chamber permits cooling or heating of the liquid being pumped.

Mounting dimensions remain the same as Viking's previous compact line of alloy heavy-duty pumps, and without increased size for jacketing.

Six sizes from 10 to 110 G.P.M. are available. Pumps operate at full speed handling light liquids—at reduced speeds for heavy, viscous liquids. Pumps suitable for pressures up to 50 P.S.I. handling non-lubricating liquids—100 P.S.I. on lubricating liquids. Completely self priming with positive discharge.



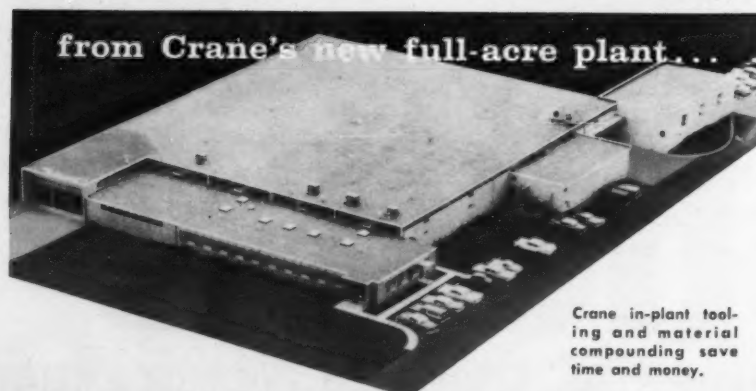
For additional information, send today for folder SP 537J

#### VIKING PUMP COMPANY

Cedar Falls, Iowa, U.S.A. In Canada, It's "Roto-King" Pumps

See Our Catalog in Sweet's Product Design File

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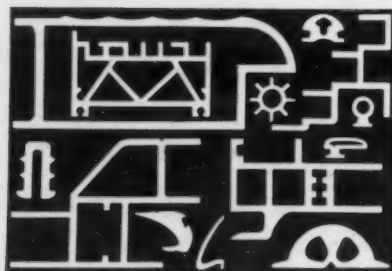
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Crane in-plant tooling and material compounding save time and money.

### Plastic extrusions — rigid and flexible — in hundreds of shapes and sizes

Complex multi-hollow extrusions solving industry design problems, cost-reducing production techniques permitting lower prices, quick delivery of critically needed

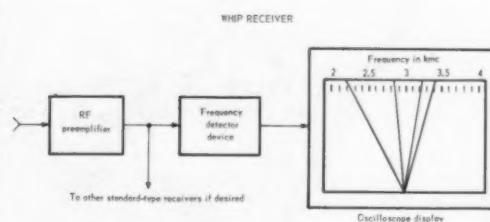
extrusions. These are routine at Crane Plastics where a reputation for solving "impossible" problems is setting Crane apart as an international leader in plastic extrusions — rigid and flexible. Write for brochure showing unique Crane extrusion applications.



**CRANE  
PLASTICS, INC.**  
2144 Fairwood Ave.  
Columbus 7, Ohio

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## IDEAS IN THE NEWS



• **MULTIPLE RADIO AND RADAR SIGNAL FREQUENCIES** in the critical space communications and electronic warfare bandwidths (500 to 12,000 mc) now can be directly identified without tuning by a Wideband High Intercept Probability (WHIP) receiver. Frequency determination accuracy of the new unit is to within 1 percent over an octave of bandwidth and its intercept probability is 100 percent. The WHIP receiver is expected to be an especially useful aid in electronic warfare where transmission, detection and jamming of electromagnetic energy is a continual struggle, as well as for use in reconnaissance satellite work.

The basic WHIP receiver consists of a low-cost passive frequency discriminator (including two matched detectors), with or without preamplifier, whose output can be displayed visually on a calibrated CRT or any properly calibrated oscilloscope. Frequencies are read out as angular lines in a manner similar for instrument pointers.

The device provides the frequency-determining features of the superhetrodyne or tuning receiver and the 100 percent intercept probability capability of a crystal video receiver, both basic receiver types currently used in these applications. With the WHIP receiver, all frequencies within its band can be identified within 1 percent.

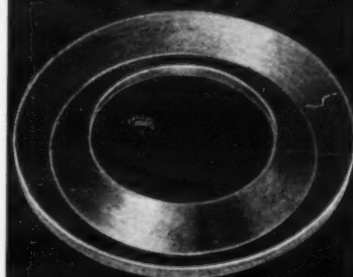
The multiple frequencies can be displayed simultaneously, providing the scope operator with an accurate picture of all frequencies seen by the receiver antenna within the octave. When used in a reconnaissance satellite, the output of the WHIP receiver's detectors can be telemetered to ground stations and read out directly or digitized for feed-through to data gathering systems. Radar frequencies can be identified readily as well as attempts to jam the satellite's communications system. The WHIP receiver system also can make calibrations of amplitude and approximate RF power measurements.

In electronic warfare, the WHIP receiver will function as a wide-open alarm, telling where to tune conventional narrow-band scanning superhetrodyne or TRF receivers and jammers. The new receiver was developed by the Hallicrafters Co., Chicago, Ill.

## NOT JUST PACKINGS!

### SPECIFY CHICAGO-ALLIS

#### FOR EXAMPLE VEE PACKINGS



- **LEATHER**—Wide variety of leathers and impregnants to accommodate a wide range of temperatures, pressures, and mediums.
- **HOMOGENEOUS RUBBER**—Natural and synthetic rubbers—especially compounded and processed for specific applications.
- **COMPOSITION**—Includes cotton and asbestos duck impregnated with synthetic rubbers, especially processed for type of fluid or medium and temperature and pressure conditions.

**All Chicago-Allis packings are available with anti-friction impregnations or coatings.**

Whether it is a problem of higher pressures, higher temperatures, extreme operating conditions, or unusual compounds or liquids... or just a matter of plain efficiency, economy, and dependability... there is a Chicago-Allis packing especially suited for the application. C-A products are used across industry... automotive, aircraft, home appliances, agricultural equipment, machine tools, and ordnance equipment. Just ask for the assistance of C-A engineers who are always available for counsel on your packing requirements.



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MFG. CORP.

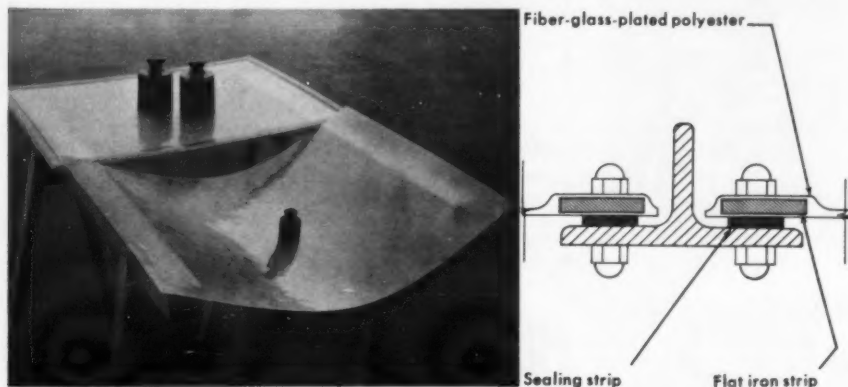
129 N. GREEN ST. CHICAGO 7, ILL.

Circle 145 on Reader-Service Card

• **FLAT IRON FRAME**, embedded during polymerization, stiffens and prestresses a window plate consisting of unsaturated polyesters and a surface layer of low-alkaline fiber glass. Primary advantage of the new compound window is easy assembly; mounting holes for bolts can be drilled directly through the embedded frame.

Light transmissivity is 85-90 percent,

with diffuse emission. Linear thermal expansion coefficient is about  $1 \text{ by } 10^{-7} / \text{deg F}$ . Thermal conductivity is 65 percent below that of glass, reducing insulation problems. The plastic material is shape consistent between  $-40$  and  $+285\text{F}$ . Plates are available in sizes up to 3 by 1 m. "Polydet" is a development of Deutsche Tafelglas AG., Fuerth, Germany. **R.F.S.**



**EMBEDDED-FRAME PLATE** shows superiority in simple demonstration: 1-lb weight bends unstiffened sheet, while prestressed plate holds 22 lb. Installation detail shows two "Polydet" plates attached to central T-upright.

## HOBBS HOUR METERS

**GIVE THE REAL  
FACTS OF INDUSTRIAL TOOL  
USE AND MAINTENANCE**

Hobbs Industrial Hour Meters provide continuous supervision of the running time of industrial machines... eliminating errors and deficiencies for maximum production. These elapsed time indicators tell when servicing is due... indicate the costs of running hour for both the machine and occupied space.

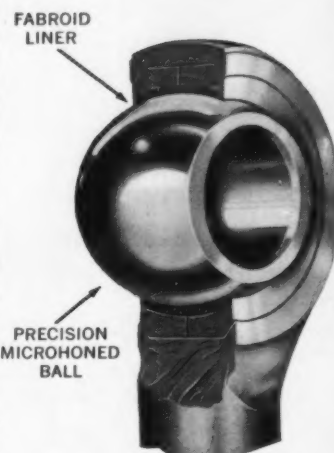
Hobbs Industrial Hour Meters make it easy to determine the life and repair costs per running hour of industrial machines... the actual running time of leased equipment and equipment to be sold. They set up a sound basis for service contracts. For complete information...

WRITE FOR CATALOG 600  
Distributors in Principal Cities

**John W. Hobbs Corporation**

A DIVISION OF STEWART-WARNER CORPORATION  
2053 YALE BLVD. SPRINGFIELD, ILLINOIS

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Typical Fabroid  
Self-aligning Bearing

**BEARINGS  
YOU  
NEVER  
LUBRICATE**



Typical Fabroid  
Journal Bearing

## FABROID BEARINGS CUT FRICTION 90%

Under severe helicopter test conditions, Fabroid bearings have gone 60,000,000 cycles *without* failure where all other bearings have failed at 50,000 cycles or less. In actual use Fabroid bearings are performing equally well. Yet Fabroid bearings *never* need lubrication!

Fabroid is a combined fabric of glass and Teflon\* fibers backed by glass cloth impregnated with phenolic. The glass-phenolic system acts as a honeycomb which traps the Teflon and prevents it from cold flowing. The result is a bearing with 1/10th the friction coefficient of lubricated metal bearings.

Fabroid has limitless bearing applications where any or all the following conditions exist: lubrication is impractical; extreme temperatures; tight space or weight conditions; abrading, galling or corrosion; contamination; static friction; shock vibration.

\*E. I. DuPont's Tetrafluorethylene

SEND FOR this informative brochure which fully describes the functional characteristics of Fabroid.



**MICRO-PRECISION DIVISION**  
OF  
**MICROMATIC HONE CORPORATION**

1535 Grande Vista Ave. • Los Angeles 23, California  
PHONE: Angeles 3-6142



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for drawing and forming stainless steel and other clean materials. Longer life between dressings. Improved machining qualities. Better impact resistance . . . Die blanks in stock as rectangles, solid rounds, and circles — diameters to 20". Also cast to your required shape . . . Write for copy of free bulletin today.

D-94



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Huntington Park, Calif. Garland, Texas

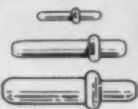
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# 50% SAVINGS

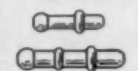
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## BEAD CHAIN® Multi-Swage Parts

### CONTACT PINS



### TERMINALS



### JACKS



### FRICTION CONTACTS



### also PRINTED CIRCUIT MINIATURE PARTS

Contact pins, terminals, jacks or any small tubular parts. Maximum 1/4" diameter x 1 1/4" length.

Send sketch for quotations.

### BEAD CHAIN DRIVES

Low-speed positive drives or motion transfer . . . at far less cost!



Send for Multi-Swage or  
Bead Chain Drive Catalogs!

## THE BEAD CHAIN MFG. CO.

93 Mountain Grove St., Bridgeport, Conn.

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## IDEAS IN THE NEWS

• "BACK PACK"-SIZED ELECTRIC POWER SUPPLY is one of many possible applications of a thermionic converter developed by Atomics International, Div. of North American Aviation, Inc. The portable generator burns a mixture of propane and air.



• BASIC VEHICLE TYPES for exploring the moon and planets are being studied at General Motors' Defense Systems Div. Soil and terrain characteristics that might influence design of lunar roving vehicles also are being analyzed.

Three basic means of land vehicle locomotion—wheels, tracks and screws—have been evaluated. Three laboratory models, presently under test, have been designed: a three-axle vehicle with large wheels suitable for irregular terrain; a tracked vehicle with the track encircling the body for use on either soft or hard soil, and a multiple-screw configuration which can progress in loose or fluffy soil even if completely buried. The three basic designs are powered by electricity and steered by remote control. The models have been driven over a variety of soils in the "soil bin" and measurements of their mobility have been made.

Actual moon-roving vehicles that could evolve from the studies could be either manned or unmanned.



## OHIO WELD NUTS



Patent No. 2908310

RN NUT—for projection welding. Ideal where tension is against the weld. Thread size 6-32 to 1/2-13



ND NUT—for spot welding. Used where large nut is needed for bridging two sheets or for extra strength. Thread size 6-32 to 3/8-16



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XN NUT—for spot welding with recessed target electrode area. Full range of sizes can be welded with 20 KVA Welder. Thread size 6-32 to 3/8-16

Samples and information furnished upon request



Primary Fastener in Fastener Assemblies

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TO 16,000 PSI**



◦ **STEEL LINE AND FITTINGS**

**3/8" Diameter Flow Passage**

**Leak-proof Fitting Seal**

**Balanced Line Valves**

**Low Torque at 12,000 PSI**

**Replaceable Seats and Spindles**

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**Minus 115°F. Dew Points**



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**PRESSURE COMPONENTS, Inc.**  
3429-D OCEAN VIEW BLVD.  
GLENDALE 8, CALIFORNIA

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• **"BOOM" ADAPTER HOSE** extends in-flight refueling capabilities to various fighter aircraft of the Strategic Air Command. The short length of special rubber, reinforced hose enables SAC planes to provide refueling for their own fighter cover on long-range missions.

SAC has been committed to the "boom" system for a number of years. Limited flexibility makes it extremely difficult to refuel fighter aircraft.

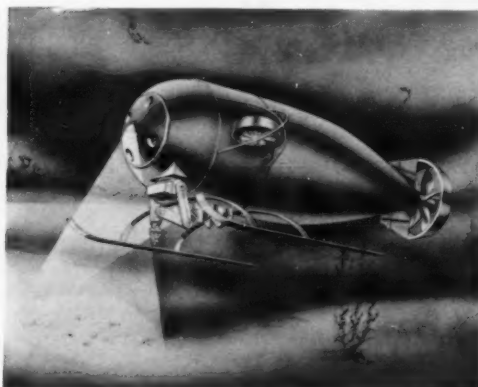
The new hose, attached to the end of the "boom", provides the necessary flexibility and required strength to refuel the fighter aircraft.

The rubber hose was developed by Hewitt-Robins, Stamford, Conn., for the U. S. Air Force in cooperation with Schulz Tool and Mfg. Co.

• **TWO-MAN UNDERSEA RESEARCH VEHICLE**, named "SEAPUP VI", is a complete undersea research system with precise maneuverability in vertical, horizontal and inclined planes. It will hover off the ocean bottom if desired or will rest on the bottom on skis while manual tasks are performed by a mechanical arm mounted at the front of the vehicle. The vehicle has its own air regeneration system, capable of supporting two men comfortably for an 8-12-hr period at any submerged depth up to 6000 ft.

Of significance is the vehicle's low weight-in-air and compact size. Air weight, including batteries, lifting fluid and all other standard equipment, is only 12,600 lb. The vehicle is approximately 18 1/2 ft long and has an overall width of 8 ft.

SEAPUP VI was developed by General Mills Inc., Minneapolis, Minn.



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**NYLINERS<sup>®</sup>**

—BEARINGS of smooth, tough DuPont NYLON



Low Cost  
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Low Cost  
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**COST LESS to BUY  
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| • RESIST CORROSION | • NON-CONTAMINATING     | • REDUCED WEAR          |

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**DEPT. 2, MANHASSET, NEW YORK**

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WITH  
**EPOXY-CLAD COILS**  
-at no extra cost!

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**AT LAST—A WEDGE-TYPE MACHINE LEVELING JACK THAT LIFTS... BUT DOESN'T SHIFT**

A major advance in precise machine leveling, the new Empco Vertical-Motion Jack gives you the convenience, adjustability and precision of wedge-type leveling—without lateral stress or shifting. Just a simple turn of the hex screw lifts up to 20,000 pounds, easily and precisely—keeps machines performing at their level best! Jack automatically compensates for uneven floors up to five degrees and may be used with anchor bolts where desired.

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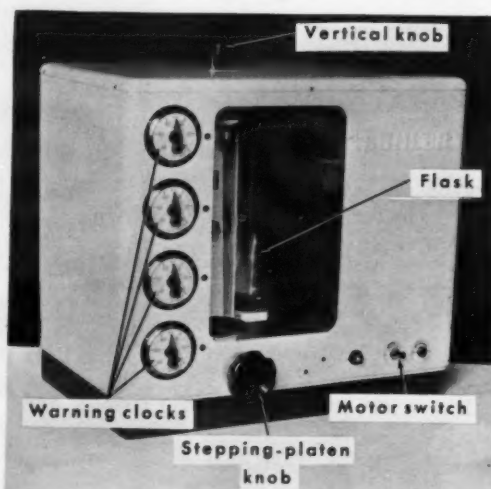
Enterprise Machine-Parts Corp., 2729 Jerome Ave., Detroit 12, Mich

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## IDEAS IN THE NEWS

• **FOUR-STEP PLATEN** engages successive planet carriers with independent friction wheels to provide defined planetary motion of each flask in a thermostatic gluten-tester. Both planetary and stepping motions are controlled by outside knobs to permit comparative tests on gluten content without removing the flasks from the sealed chamber.

Each flask is placed with its flat bottom on the rubber-rimmed planet wheel and is screw-clamped from the top. A large motor-driven disc rotates the planet and its flask about the spinning



FRONT PANEL of thermostatic tester includes warning clocks for each flour sample, motor switch and knob for manual control of stepping platen. Vertical knob on top causes planetary motion of rotating flask. Glass pane facilitates visual checking of testing process. Heating resistors and thermostat (not shown) provide constant inside temperature. Thermostatic unit permits accurate classification of flour samples according to their gluten content and also is used to calibrate testers of other type.

axis, while a manually actuated miter gear turns the C-shaped carrier. Planetary motion produces constant agitation of the liquid; warning clocks check shaking time of the various flasks.

The miter gearing includes a knurled wheel which is spring-forced against the rim of rubber pinions. Radial pivots on the platen edge hold the pinions and the planet carriers. The flour-sample tester is a design development of Costruzioni Meccaniche Marchetti F. Antonio, Milan, Italy.

C.O.L.

**FHP motors... engineered especially for your product**



**RAE motors**

The new RAE M-40 Series, in 3 ratings at 5000 RPM. AC/DC Universal or DC Shunt. M-41 and M-42 rated 1/2 H.P. M-43 and M-44 rated 3/4 H.P. M-45 and M-46 rated 1 H.P. Available with any of RAE's gear units.

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\*Send for the "RAE" Engineering Data Sheet. It will help you supply the data necessary for recommendations and prices.

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AC/DC Universal • DC Shunt Wound • DC Series Wound • Gear Reduction Motors • Governor Controlled Motors • Motors for Rheostat Control • Motors for Electronic Control • Permanent Magnet Motors and Gearmotors.

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We have facilities, experience and engineering counsel which may meet your special requirements—exactly. Three large, well equipped plants at Aurora, Ill., York, Pa. and Los Angeles geared to economical production.

Years of experience handling thousands of special items... products, parts, sub-assemblies, merchandising units, made to your specifications.

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DESIGN NEWS—NOVEMBER 10, 1961



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and FINISH...**

**NEW  
CATALOG  
TELLS  
HOW**

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### CAN IMPROVE YOUR PRODUCT

Get the answers to any questions you may have about product improvement through machine lapping. You'll see why you can specify a flatness of .0000116" and a finish of 2 to 3 AA and be sure that you'll be able to produce it on a production basis with the Lapmaster. Send for your copy of the new Lapmaster catalog.



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Crane Packing Co., Ltd., Hamilton, Ont.

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Specify **CAMBION®** panel handles

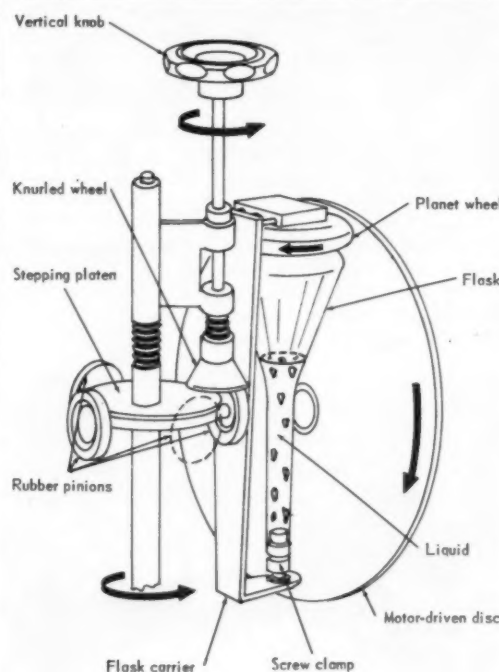
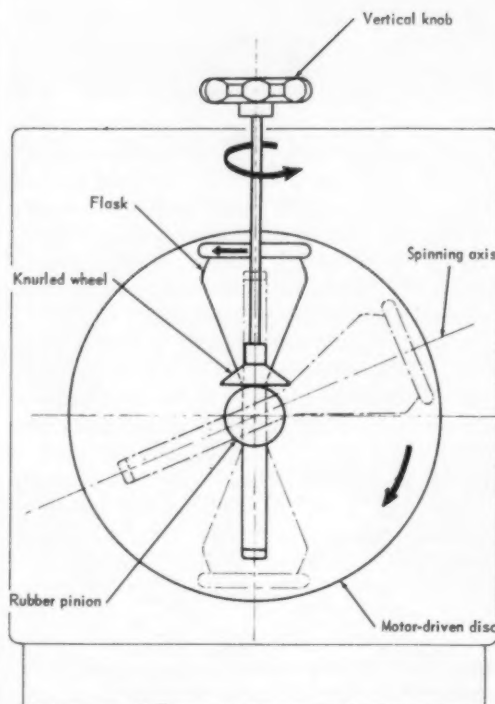


You can be certain of flawless finishes on CAMBION Panel Handles when you install them. They're buffed before plating to remove every surface imperfection... color buffed after plating for lasting luster. Then they're packaged in individual envelopes... positive protection against damage no matter how often they're handled, or how long they're stored before use. Available in 36 different standard combinations: rigid, adjustable, and folding types. Finishes of polished nickel, black oxide, semi-frost and black aluminite. Base metal: aluminum or brass. Write Cambridge Thermionic Corporation, 321 Concord Avenue, Cambridge 38, Mass., for full details on these and other products in the wide line of

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The guaranteed electronic components

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**MITER GEARING** develops planetary motion; motor-driven disc rotates flask about its spinning axis. Spinning speed is constant, whereas number of revolutions (normally low) is established manually by operator.



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**ROTAMETER/CONTROLLERS  
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- Compact—no external piping.
- Higher flow and pressure ratings (up to 12 gpm water or 48 scfm air at pressures up to 500 psig.)
- Standard materials of construction—brass or stainless steel.
- Positive indication of diaphragm failure.
- Easily and attractively panel-mounted.
- Low in cost.

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Triangle fits the bearing to the application. Whether you can use a standard, like the Pillow Block above, or need a special such as the Pedestal or Clamshell Bearings shown below, your particular bearing problem receives the individual attention best assuring cost reductions—quality improvements.

### SELF-ALIGNING... SELF-LUBRICATING SLEEVE-TYPE PILLOW BLOCKS



The widest selection of mountings available—functionally designed, efficiently produced. Experienced sales engineers available to help you anywhere. Phone or write for descriptive literature.



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## NEW NYLON & THERMO-PLASTIC parts from GRC

Economically mass produced on fully automatic patented machines, GRC nylon parts are available from stock in many sizes and types. GRC uses single cavity techniques, molds in one automatic cycle, gets accurate, uniform parts.

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NO SIZE TOO SMALL  
Maximum:  
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— .05 oz.



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GRC's complete line of high quality, close tolerance molded nylon screws and hex nuts include screws in standard commercial heads—Phillips or slotted sizes—in sizes from #4 thru 1/4"; hex nuts in ten sizes (#2 thru 5/16") GRC molded nylon miniature machine screws—half the weight of aluminum—in sizes as small as #0—make more compact designs possible. GRC's single cavity molding technique adds exceptional uniformity, accuracy, economy to nylon's high strength-to-weight ratio, built-in electrical insulating qualities, stability, resilience and elasticity. GRC's molded fasteners are available in Nylon or Delrin in a wide range of types, sizes and lengths.

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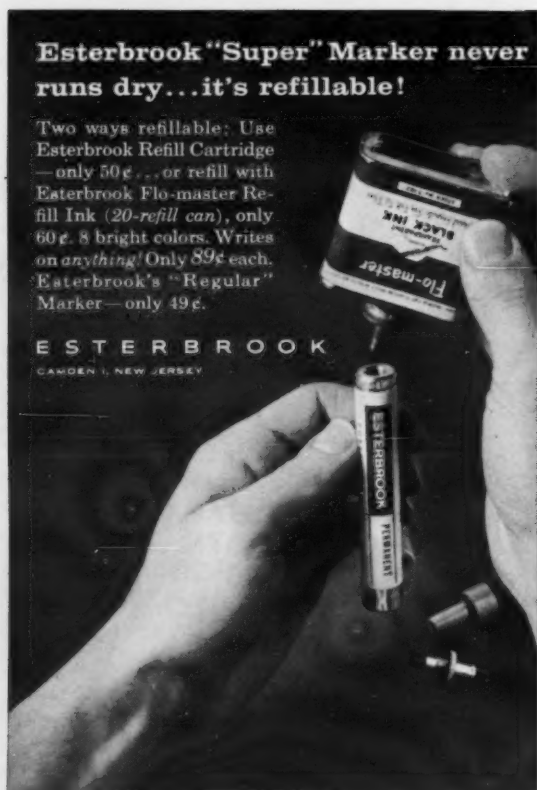
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## IDEAS IN THE NEWS

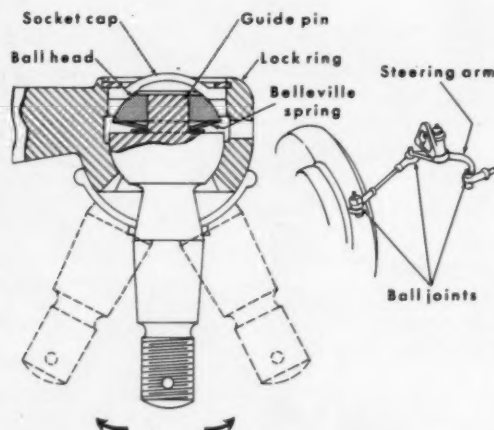
• **CENTRAL GUIDE-PIN** absorbs side forces acting on the hemispherical ball head of a ball-and-socket joint. Wear and jamming are reduced considerably by eliminating twisting stresses on the ball head and side deflection.

Common ball joints for automobile steering mechanisms use coil or disc springs between ball halves to provide a tight fit. Nonaxial stresses, originated by relative motion of the joined arms, deflect the spring obliquely, causing frequent spring failure and/or changes in the spherical shape of ball halves. Increased friction drops efficiency and brings on jamming.

The pin-guided ball halves form almost frictionless, long-lasting joints. They allow spring expansion or deflection only in the axial direction. Since several joints of this type are used within the steering gear, smoothness and efficiency of the whole mechanism are improved remarkably.

The ball joint, an international patent by Officine Meccaniche Dante Villa, Casatenovo Brianza, Italy, is used in various Italian cars.

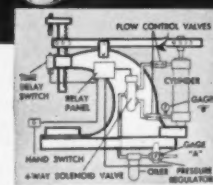
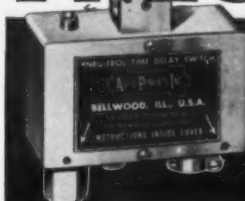
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FOR CONTROLLED TIME DWELL OF AIR OR HYDRAULIC CYLINDERS



Arbor press converted to high production power press, using double end cylinder, Time Delay Switch, Flow Control Valves, and related equipment, Flow Valves permit independent ram speed adjustment in both directions. Differential pressure between "A" and "B" gauges caused by throttling effect of Flow Control Valve creates time interval in working pressure build-up, which is compensated for by Time Delay Switch setting. This insures consistently accurate working pressure on the ram.

- Holds dwell accurately to fraction of second
- Automatically re-sets
- Designed for millions of actuations

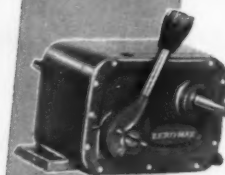
Pneu-Trol Time Delay Switch will hold any cylinder controlled motion or operation at a positive stop on either end of the stroke for 1/4 to 60 seconds in 20 to 1 ratios. Simple, easy to adjust. Automatically re-sets after each actuation. Positive, controlled time dwell permits wider use of air or hydraulic power in automatic operations, increases accuracy of work by insuring split-second accuracy of time dwell. Available with many thrust linkages for left and right, down, up, or horizontal thrust. Write for Special Bulletin TDS-59



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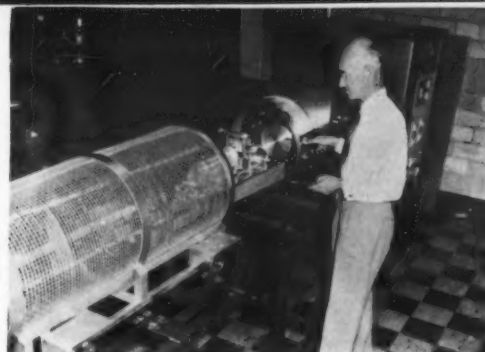


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IE & MFG. CO.**

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• **HIGH-VACUUM DEMOUNTABLE SYSTEM**, developed for experimental work in electron optics, aids in making better electron tubes possible. The instrument consists of a 4 1/2-by 1 1/2-ft bell jar, adjustable tube parts and a vacuum system featuring a large ion pump.

The instrument provides space in vacuum for large scaled models of electron guns, evacuates its bell jar to a pressure of one millionth of a millimeter of mercury and provides adjustment of built-in experimental tube parts.

In operation, the bell jar, mounted horizontally on a frame with rollers, is brought forward on rails around the adjustable tube parts. The bell jar then is evacuated by use of the ion pump. The electron tube parts then may be adjusted by a unique system of magnets, rods, pulleys and wires.

This system represents a considerable improvement over previous instruments of this type. It was developed by the Westinghouse Cathode Ray Laboratories at Elmira, N.Y.

## MEETINGS

New York, N.Y.  
Nov. 26-Dec. 1

WINTER ANNUAL MEETING, American Society of Mechanical Engineers, Statler Hilton Hotel.

Washington, D.C.  
Dec. 3-7

EASTERN JOINT COMPUTER CONFERENCE, Institute of Radio Engineers, American Institute of Electrical Engineers and Assn. for Computing Machinery, Sheraton-Park Hotel.

Orlando, Fla.  
Dec. 4-6

AEROSPACE SUPPORT AND OPERATIONS MEETING, Institute of the Aerospace Sciences.

Hartford, Conn.  
Dec. 6-7

ELECTRIC MACHINING AND FORMING SEMINAR, American Society of Tool & Mfg. Engineers, Statler Hilton Hotel.

Denver, Colo.  
Dec. 26-31

ANNUAL MEETING & EXPOSITION OF SCIENCE AND INDUSTRY, American Association for the Advancement of Science, Denver Hilton Hotel.

Las Vegas, Nev.  
Dec. 27-28

REGIONAL ANNUAL MEETING, American Society for Engineering Education.

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Adjustable for signalling pressure and differential pressure from 0.25" wc to 200 psi (or psid) in systems to 5000 psi and -65° to +275°F; leak-proof. Units sound alarm, light bulb, turn motor on or off, operate valves—remotely or in place. \$40 to \$75

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Extended pressure and temperature ranges available in all instruments.

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TWO-WAY SHUT-OFF  
COUPLINGS

**QUICK  
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*with instant  
automatic flow*

**QUICK  
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*with instant  
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...prevents loss of liquid,  
gas, or pressure*



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SINCE 1915



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**THE HANSEN**

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## PLANS AND CROSS-SECTIONS

### Computer Comments

#### Miniature Computer Is Size of Bread Loaf

A "baby" computer, the size of a loaf of bread, has been developed at the Burroughs Corp.'s Laboratories, Paoli, Pa.

Company spokesmen said a working model was built to show that existing electronic components can be used in shrinking a commercial computer from room size to the size of a desk, and

that military electronic equipment can be compressed to a convenient size for aircraft, spacecraft and missiles.

The computer has 5500 components in a space measuring 3 by 6 by 11 inches, weighs 12 lb, and can perform 33,000 mathematical calculations per sec.

#### Computer Learns and Teaches Geometry

Massachusetts Institute of Technology students recently were offered the intriguing opportunity of taking a one-hour experimental course on an IBM 709.

The computer gave the course to 20 students. It was a course in miniature geometry, based on two definitions and four axioms. The machine sped one man through the course in 33 minutes but took 78 minutes to make certain that another fellow mastered the subject.

Each student was seated at a microfilm projector with notepaper and electric typewriter. The machine gave instructions and put forth questions on the projection screen, and the student

answered by punching appropriate keys on the typewriter. A book of instructions was stored in the computer's memory and the machine determined what material should be presented to each student in the light of its previous experience and its appraisal of each individual's needs. The computer proceeded, in other words, as though it were playing a game; it considered the possible alternatives at each stage of the course and chose the one that seemed most advantageous.

Richard D. Smallwood, a graduate student, programmed the computer to do this as part of his study of the use of computers as aids to education.

#### Palm Prints Analyzed By Electronic Computer

An electronic computer has been used to analyze characteristics observed in human palm prints. The analysis may lead to a new method for detecting the presence of certain inheritable conditions, according to Dr. H. Warner Kloefer of Tulane University.

Dr. Kloefer notes that the study of palm prints is closely related to the study of fingerprints. Only the very fine, almost indistinguishable lines on the skin surface are recorded.

When scientists classified some 2000 palm prints made in Germany before World War II, they found between seven and 65 variables in a feature area. There are ten such feature areas in a single palm. With the aid of an electronic computer, the scientists further studied the

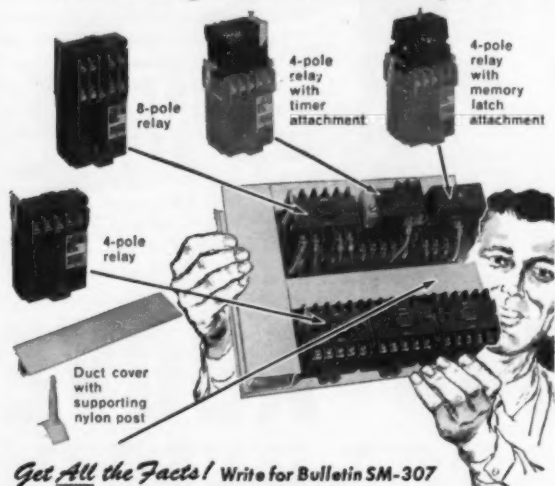


vast number of interrelationships between the variables in different feature areas.

By comparing the frequency with which characteristics in the left hand appeared in the right hand, they determined the extent to which certain of the characteristics are inheritable.



## NEW Square D 300-volt Control System for Outstanding Versatility, Drastically Reduced Panel Space!



Get All the Facts! Write for Bulletin SM-307

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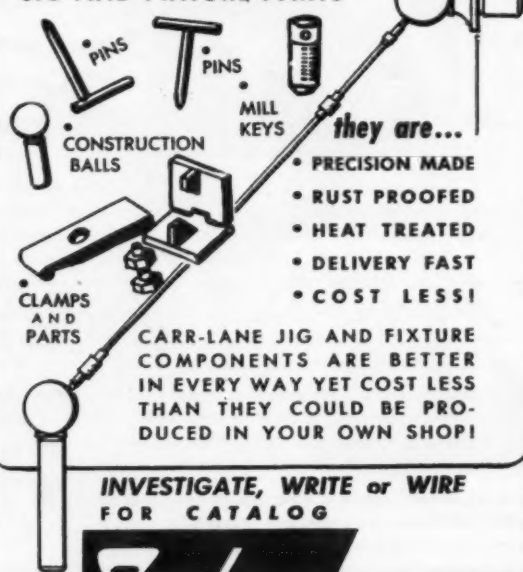


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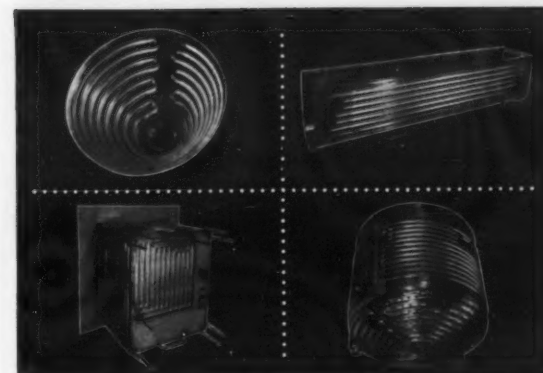
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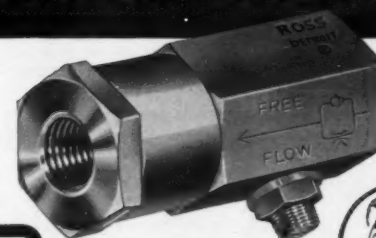


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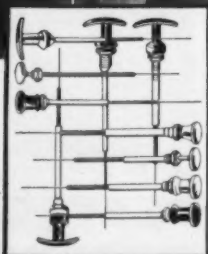
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Master-mite  
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In services up to +500° F and down to -400° F, AMPCO metal has proven its ability to retain an unusually high percentage of its room-temperature characteristics. This series of special copper-base alloys is available in most any form.



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Regardless of cost, the best fastening devices aren't worth a cent if corrosion shortens their useful lives. Driv-Lok grooved pins can be produced in a variety of metals and finishes designed to give you a positive lock, lasting through harmful effects of moisture, acids, alkalies, oils, solvents and other chemicals.

From its raw material inventory of carbon and alloy steels, stainless, silicon bronze, brass and aluminum, Driv-Lok can fill your need for corrosion-resistant pins in extremely short order.

Finishes? Standard is zinc electro plate. Heavier deposits, dichromate dips, and other finishes such as brass, nickel, cadmium and black oxide, are immediately available.

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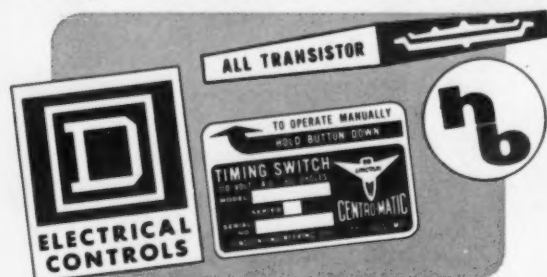
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DESIGN NEWS—NOVEMBER 10, 1961



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\*DuPont's Reg. T.M.

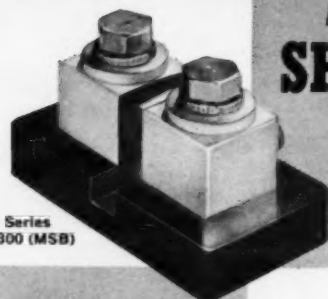
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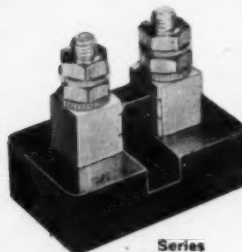
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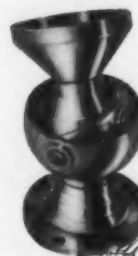
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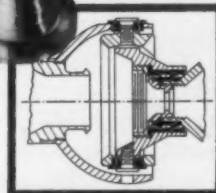
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## READY TO ROLL

Instrument sub-assemblies complete  
with precision-fitted miniature  
or instrument ball bearings



If you have a problem making or obtaining some of the proper components for instrument bearing sub-assemblies—or if you have trouble fitting them together with the required precision—you should

investigate the services of the Rotassembly Division at New Hampshire.

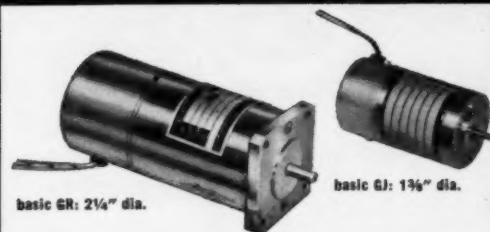
In this separate facility, assemblies including bearings, shafts, housings and pulleys are produced to your designs, to New Hampshire precision standards and shipped to you inspected, tested and ready to install.

Manufacture is restricted to mechanical units in which the correct installation and performance of bearings are important and critical elements of the assembled unit. We are not manufacturers of or qualified to produce gears, gear trains, gear boxes, motors or electrical components.

For more complete information, write for Rotassembly Bulletin.

**NEW HAMPSHIRE BALL BEARINGS, INC.**  
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basic GR: 2 1/4" dia.

basic GJ: 1 1/4" dia.

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Small size and weight, wide design versatility, broad speed and torque ranges, instant reversibility... Globe's wound field MIL spec motors can solve your requirement! Here are two cases in point:

**TYPE GR** 2 1/4" dia. frame size provides continuous duty outputs to 1/6 hp at 8,000 rpm. Weight: 2.0 lb. Units can be wound for a.c./d.c. universal, split series, series, shunt, or split shunt, and can include an integral brake or governor, and a special gear reducer. Request Bulletin 114.

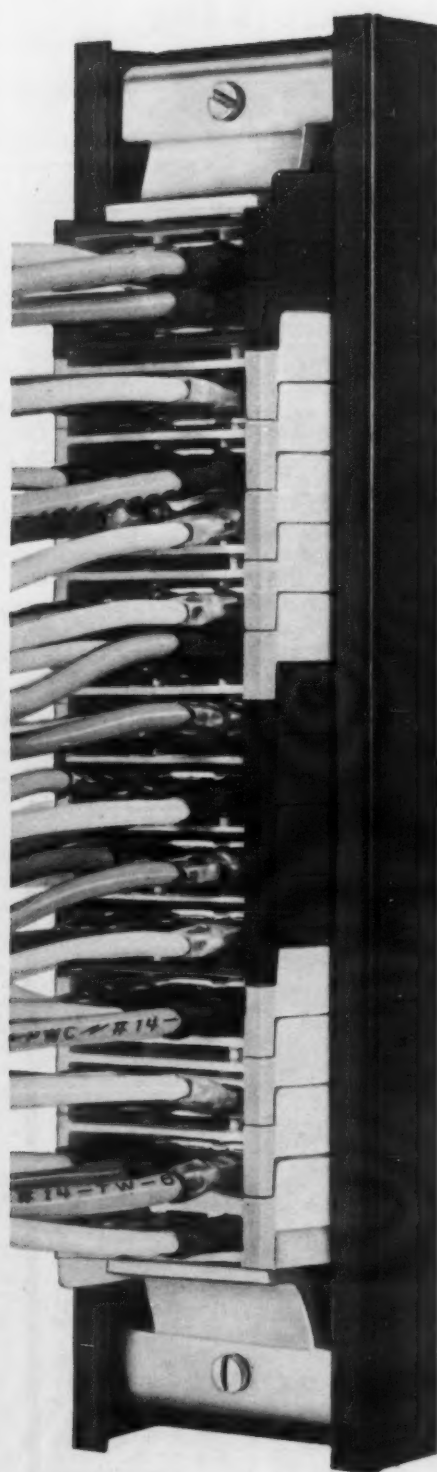
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INC.**

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WITHOUT TOOLS!**

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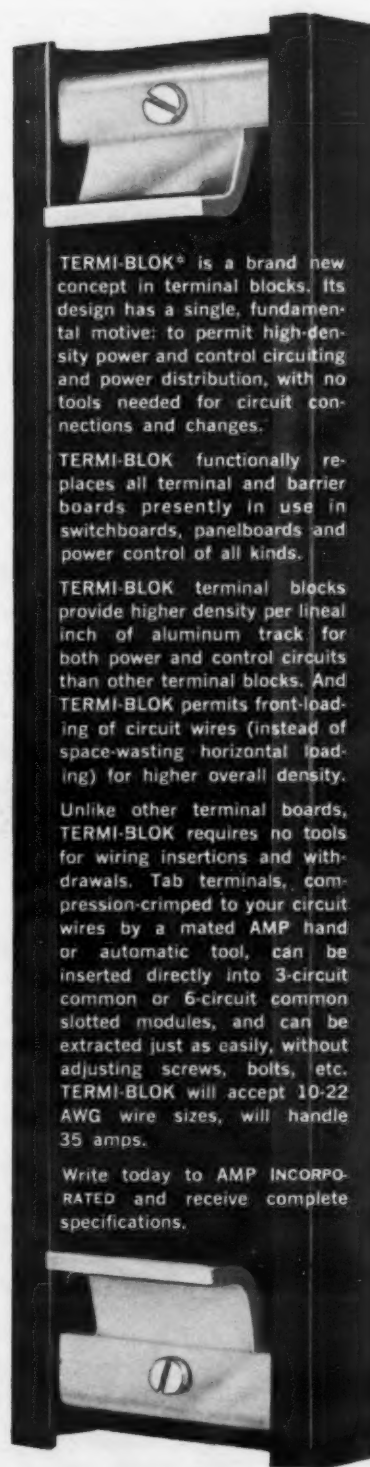
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\* Trademark



TERMI-BLOK® is a brand new concept in terminal blocks. Its design has a single, fundamental motive: to permit high-density power and control circuiting and power distribution, with no tools needed for circuit connections and changes.

TERMI-BLOK functionally replaces all terminal and barrier boards presently in use in switchboards, panelboards and power control of all kinds.

TERMI-BLOK terminal blocks provide higher density per lineal inch of aluminum track for both power and control circuits than other terminal blocks. And TERMI-BLOK permits front-loading of circuit wires (instead of space-wasting horizontal loading) for higher overall density.

Unlike other terminal boards, TERMI-BLOK requires no tools for wiring insertions and withdrawals. Tab terminals, compression-cripped to your circuit wires by a mated AMP hand or automatic tool, can be inserted directly into 3-circuit common or 6-circuit common slotted modules, and can be extracted just as easily, without adjusting screws, bolts, etc. TERMI-BLOK will accept 10-22 AWG wire sizes, will handle 35 amps.

Write today to AMP INCORPORATED and receive complete specifications.

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AMP products and engineering assistance are available through subsidiary companies in: Australia • Canada • England • France • Holland • Italy • Japan • Mexico • West Germany

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Design News, November 10, 1961  
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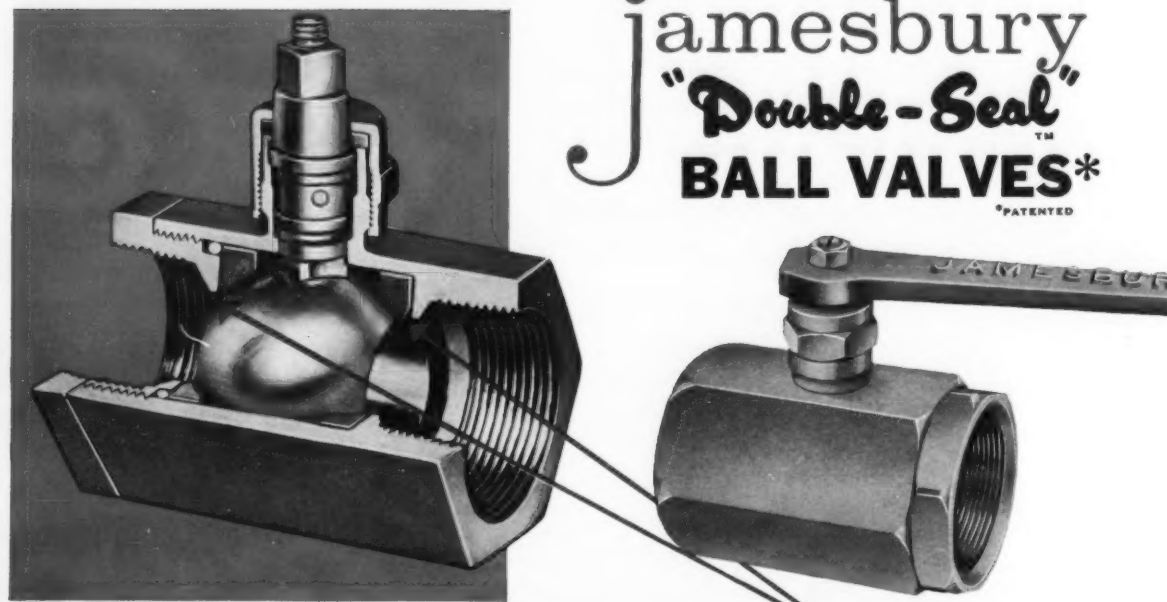
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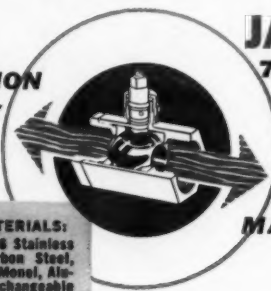
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